EXCAVATING ENGINEER

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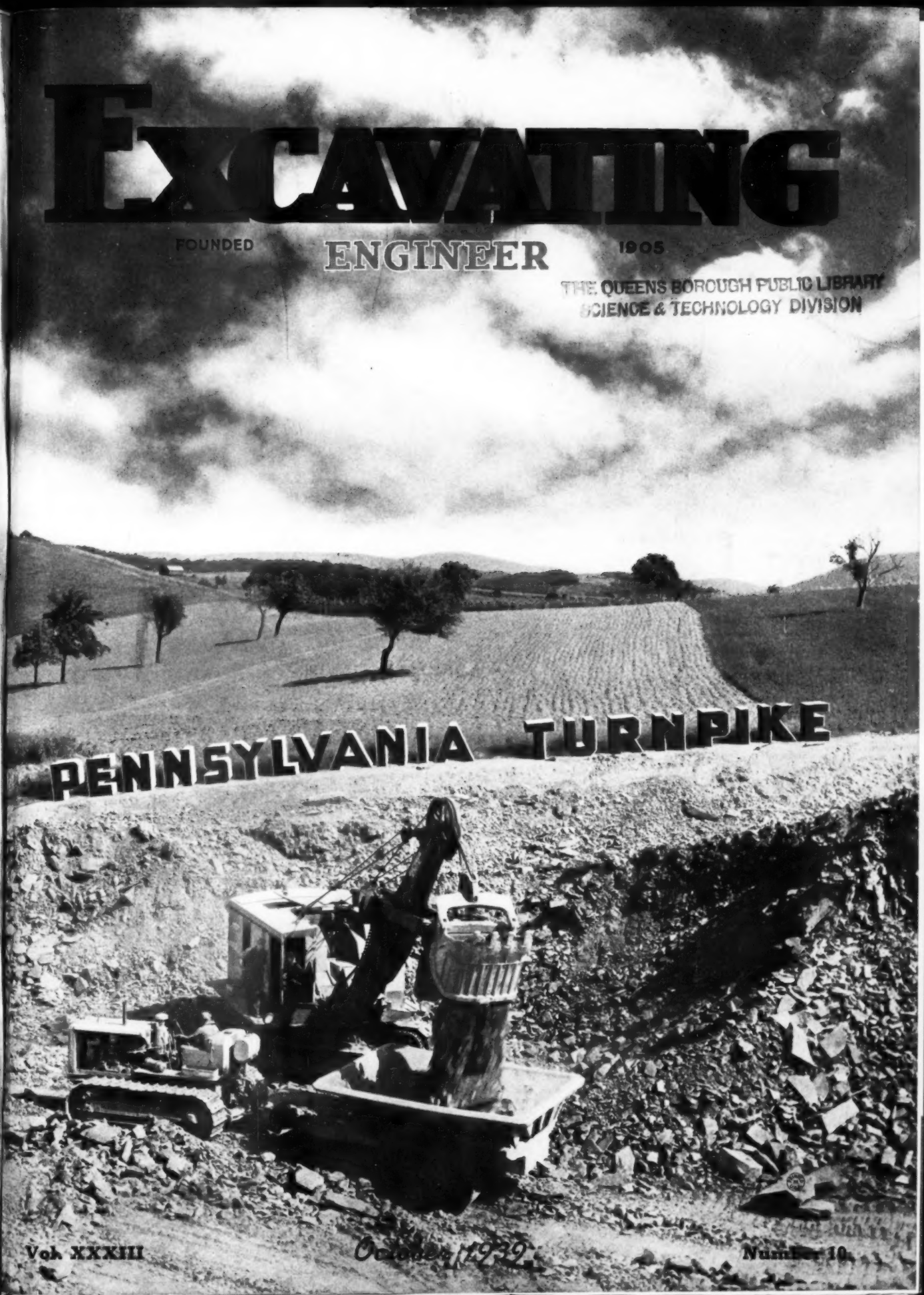

Vol. XXXIII October 1939 Number 10

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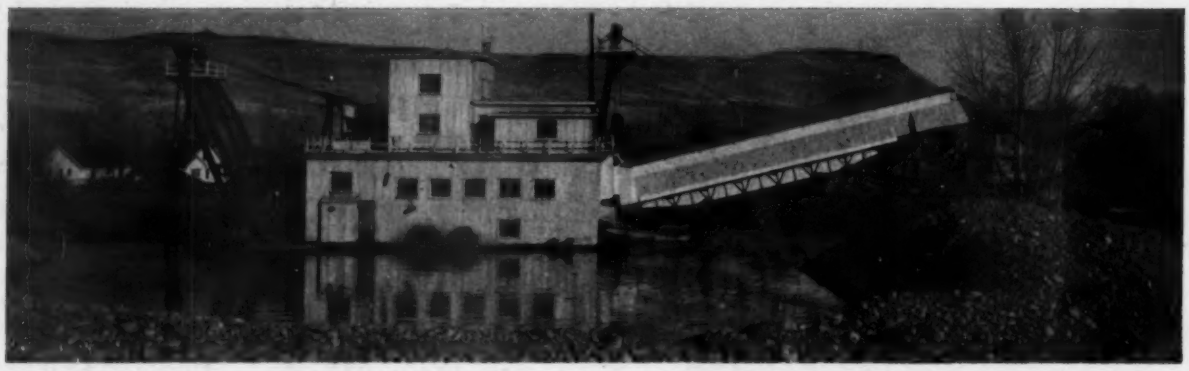
WESTERN DREDGING OPERATIONS *Demonstrate* ATLAS *Dependability*

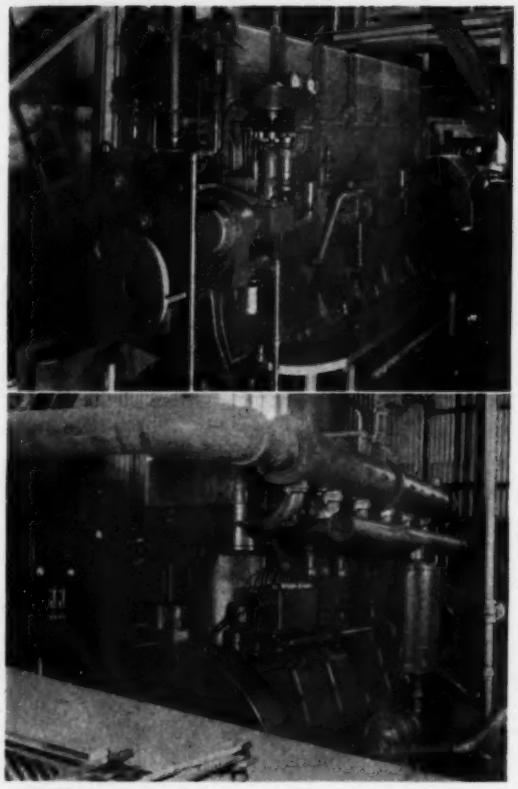


Dependability—that inherent quality of an Atlas Diesel which permits it to deliver a continuous flow of power over long periods without mechanical difficulties, is demonstrated by the record of two Atlas Diesels used by the Western Dredging Co. at John Day, Oregon.

These two engines are of the heavy duty, enclosed type, 9" bore and 10½" stroke, rated 200 H.P. at 514 R.P.M. They power a 6 cu. ft. Johnson Dredge placed in service November 14, 1937. These engines have averaged over 22½ hours operation per day, piling up 13,488 hours for each engine, with no shutdown time chargeable to either engine. The dredge is stopped twice a day for oiling and twice a month for gold recovery, and in spite of these interruptions, the dredge has averaged over 22½ hours daily for the past 594 days.

That's the kind of service you can expect of heavy duty Atlas Diesels. They are built to stand the service requirements that would wreck a lighter engine. They are designed for continuous—24 hour per day operation.

If your power requirements for a generator, compressor, hoist, or dredge call for continuous service—if shutdown time costs you money—then you will want a heavy duty Atlas Diesel. Engines of this type are available in 4 sizes, rated 135, 165, 200 and 275 H.P. Other models from 5 H.P. to 600 H.P. A catalog will be mailed you on request.



ATLAS IMPERIAL DIESEL ENGINE CO.

Eastern Division
115 Broad Street
New York, N. Y.

Central Division
228 N. LaSalle St.
Chicago, Illinois

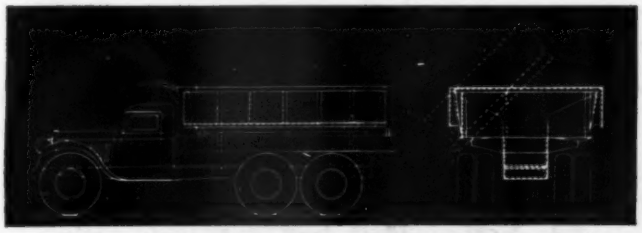
Southwestern Division
5726 Navigation Blvd.
Houston, Texas

Western Division
1000 Nineteenth Ave.
Oakland, California

Gloucester - Baltimore - Providence - Philadelphia - Charleston - Miami - Jacksonville - Tarpon Springs - New Orleans Fort Worth - El Paso - Terminal Island - Seattle - Portland - Vancouver - Ketchikan - Honolulu - Manila.

ATLAS *Imperial* DIESEL ENGINES

Pneumatic Tired for Speed...



12-Yard Two-Way Side-Dump Truck Body Controlled From Cab

Will dump to either side. Handles every size of chunk. Discharges faster than conventional end dump trucks. Capacities up to 30 tons.

25-Ton 12-Yard Two-Way Side-Dump Trail Car

Handles the largest chunks a shovel dipper can load. Special drop door design provides extra clearance for fast get away from the dump. The pivotal design of the Two-Way Side-Dump mechanism requires very little lifting effort for quick discharge. As the hydraulic ram starts the lifting operation the weight of the load helps to tip the car floor to an angle of 45 degrees. The speed and safety of this discharge feature has been proved on thousands of Western Side-Dump Railroad Cars. Cab controlled.

Low Cost Operation

● In its line of trail cars and dump bodies Austin-Western has successfully combined the endurance of the famous "Western" Dump Car with the speed and low operating costs of pneumatic tired haulage equipment.

The entire chassis has been built to take the shocks of direct shovel loading and rough roads: heavy duty axles and springs, cast steel wheels, steel-wood-steel floor, and specially designed fifth wheel. Tough alloy steels are used to reduce dead weight in the body construction providing top pay load hauls at motor truck speeds. Years of continuous operation under the most punishing conditions have demonstrated the dependability of Austin-Western haulage equipment.

Write us for construction details and operating data.

THE AUSTIN-WESTERN
ROAD MACHINERY COMPANY
AURORA, ILLINOIS

·Austin-Western·

For your convenience in writing to The Austin-Western Road Machinery Co., you will find a card bound in this issue.

How GELAMITE became the Standard Explosive for TUNNELING

AN EXAMPLE OF EXPLOSIVES PROGRESS

1. EXPLOSIVES HISTORY was made in 1929 when Hercules introduced Gelamite—the first semi-gelatin explosive.

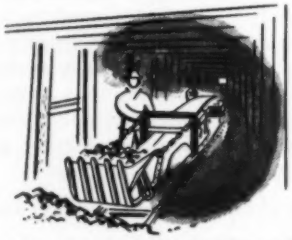
2. WITH MORE CARTRIDGES per 100 lbs., Gelamite offered substantial savings over older gelatin types.

3. REPLACING regular gelatin grades, cartridge for cartridge, it gave the same breakage under comparable conditions.

4. IN WATER RESISTANCE, Gelamite came through with flying colors—found O.K. for practically all tunnel conditions.

5. ON FUMES, too, Gelamite stacked up with gelatins. Mucking could start with minimum delay.

6. THE MINERS like it. It is cohesive, plastic, and soft packed like the gelatins.



7. CONTRACTORS AT ONCE saw the value of Gelamite. It has been used since on major tunnel jobs of the country.

8. HERCULES RESEARCH has resulted in constant improvements and refinements since Gelamite was introduced.

9. IN TEN YEARS Gelamite has come of age. No longer a "new powder," it is now the standard tunnel explosive.

E-22

HERCULES POWDER COMPANY
INCORPORATED
972 KING STREET
WILMINGTON, DELAWARE

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KING OPERATOR
His skill "on the throne" largely determines your profits. Give him *the* dragline that will give you his best. Give him a Bucyrus-Monighan and he'll "rain" with profitable dirt.
BUCYRUS MONIGHAN
Sold by
G 24
Bucyrus·Erie
SOUTH MILWAUKEE, WISCONSIN

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

How you can lengthen wire rope life

BY PROPER SHEAVE MAINTENANCE

No. 3 in a series of informative articles for wire rope users, prepared by the MACWHYTE *(Wire Rope) Company.*

What to Watch For:

Keep a sharp look-out for these two wire rope enemies

(a) corrugated sheaves,
(b) pinching sheave grooves.

To get the most for your wire rope dollar, make sure that sheaves and wire rope work together in harmony. Grooves must be smooth and must also be slightly larger than the diameter of the rope to prevent pinching and excessive wear.

Contrary to popular opinion a sheave groove usually wears smaller, not larger.

Naturally, therefore, the deeper a sheave is worn the more it pinches the rope. Friction is increased, and the rope is forced to do more than its normal share of work. Pinching shortens the rope's service life.

Corrugations. In a sheave groove, corrugations are caused by the wire rope, yet the rope will not continue to engage these corrugations (as, for example, a chain engages a sprocket). A slight twist of the rope, or a very small change of lay will prevent wire rope from tracking in the corrugation. Corrugations in a sheave are an indication either that the sheave is too small or that the material in the sheave is too soft.

How You can Save Wire Rope Dollars.

1. *Periodically inspect your sheaves and recondition them.* Make sure the sheave runs true and does not wobble on its bearing; keep the groove free from roughness or burrs of any kind; make sure the groove is *larger* than the wire rope.

2. *When buying new sheaves . . .* see that they are made of material that will stand up under the rope pressures encountered*— and make sure that the grooves are of proper size for the rope.

3. *REMEMBER,* the longer you delay reconditioning your sheaves, the more you reduce the life of your rope. The best wire rope in the world loses every time in a battle with corrugated and pinching sheaves.

Above. *A "stuck" roller. Note how the rope has cut into the roller; in a short time, this "sawing" action will ruin the rope. Proper installation and maintenance would have saved many dollars here.*

At Right. *This deeply scored sheave will take a heavy toll in rope life from the best of ropes.*

Handy Reference Table on Groove Diameter Tolerances

The following table gives the tolerances recommended for groove diameter for various sizes of rope. The tolerances shown are for diameter of groove and are added to nominal diameter of rope.

Nominal Diameter of Rope	Min. Clearance before sheave replacement or re-machining of grooves	Clearance for new or re-machined grooves	
		Minimum	Maximum
¼″ and 5/16″	1/64″	1/32″	3/32″
3/8″ to ¾″	1/32″	3/64″	1/64″
7/8″ to 1⅛″	3/64″	1/16″	1/8″
1¼″ to 1½″	1/16″	5/64″	11/64″
1⅝″ to 2″	3/32″	7/64″	13/64″
2⅛″ to 2¼″	3/32″	7/64″	15/64″

*More complete information on "Sheaves and Drums" are given in the MACWHYTE General Wire Rope Catalog G-13 together with other useful information—your copy furnished on request.

REPRINTS AVAILABLE *of this and other informative articles on wire rope.*

Simply address: Macwhyte Co., Dept. EE-10, Kenosha, Wis.

MACWHYTE COMPANY. Home Offices, Kenosha, Wisconsin. Manufacturers of PREformed, Internally Lubricated, Laboratory Tested and Field Proved Wire Ropes and Braided Wire Rope Slings, for every use . . . New York . . . Pittsburgh . . . Chicago . . . Ft. Worth . . . Portland . . . Seattle . . . San Francisco. (Distributors throughout the U.S.A.)

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THE NEW GARGOYLE VISCOLITE OIL

"Shock-Pro

When weather is bad and service heavy, the new Gargoyle Viscolite Oils' tough, cushioning oil film stands up and protects bearing surfaces!

In your paving machines, power shovels, and heavy equipment these oils help:

☛ **Reduce on-the-job breakdowns by cushioning shock loads—flowing readily to all moving parts.**

☛ **Reduce leakage...and help build savings from low oil consumption.**

THE SOCONY-VACUUM man offers you a complete line of lubricants, plus these *exclusives:*
The right lubricant for every machine . . . and new lubricants ahead of new needs . . . developed by world-famous research laboratories through close cooperation with machine builders.

73 years' experience—thousands of case histories—to guide in prescribing the right use of these lubricants to gain Lubrication Profits for you.

World-wide distribution and guaranteed uniformity—the same quality available everywhere.

For your convenience in writing to Socony-Vacuum Oil Co., Inc., you will find a card bound in this issue.

OIL PROTECT HEAVY EQUIPMENT WITH A "roof" Oil Film!

Another Tough Job for
OIL FILM
Successful operation of every machine depends on the quality of the oil that forms the microscopic coating which helps prevent metal-to-metal contact.

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Industrial Service and Lubricants Help to Lower Costs by

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General Petroleum Corporation of California

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Flotation for SPEED over Rough and Soft Haul Roads

Extra large pneumatic tires provide maximum flotation for the Koehring Trail-Dump. Heap loads do not "bog down" the Trail-Dump. High speed travel is maintained because the extra large tires "float" the load over rough roads, shifting sand, soft mud . . . Hauling costs are reduced when the Koehring Trail-Dump is on the job, because traction delays are lessened, high speed is maintained, big loads are hauled. Trail-Dump pneumatic tire flotation is greater than most other hauling units.

KOEHRING COMPANY, Milwaukee, Wis.

Free swinging, vertical hanging doors have ample clearance, when open, for ability to "get off the load" when dumping. Large tires, sturdy body and high speed Koehring Tractor are additional yardage cost saving features.

HEAVY-DUTY CONSTRUCTION EQUIPMENT

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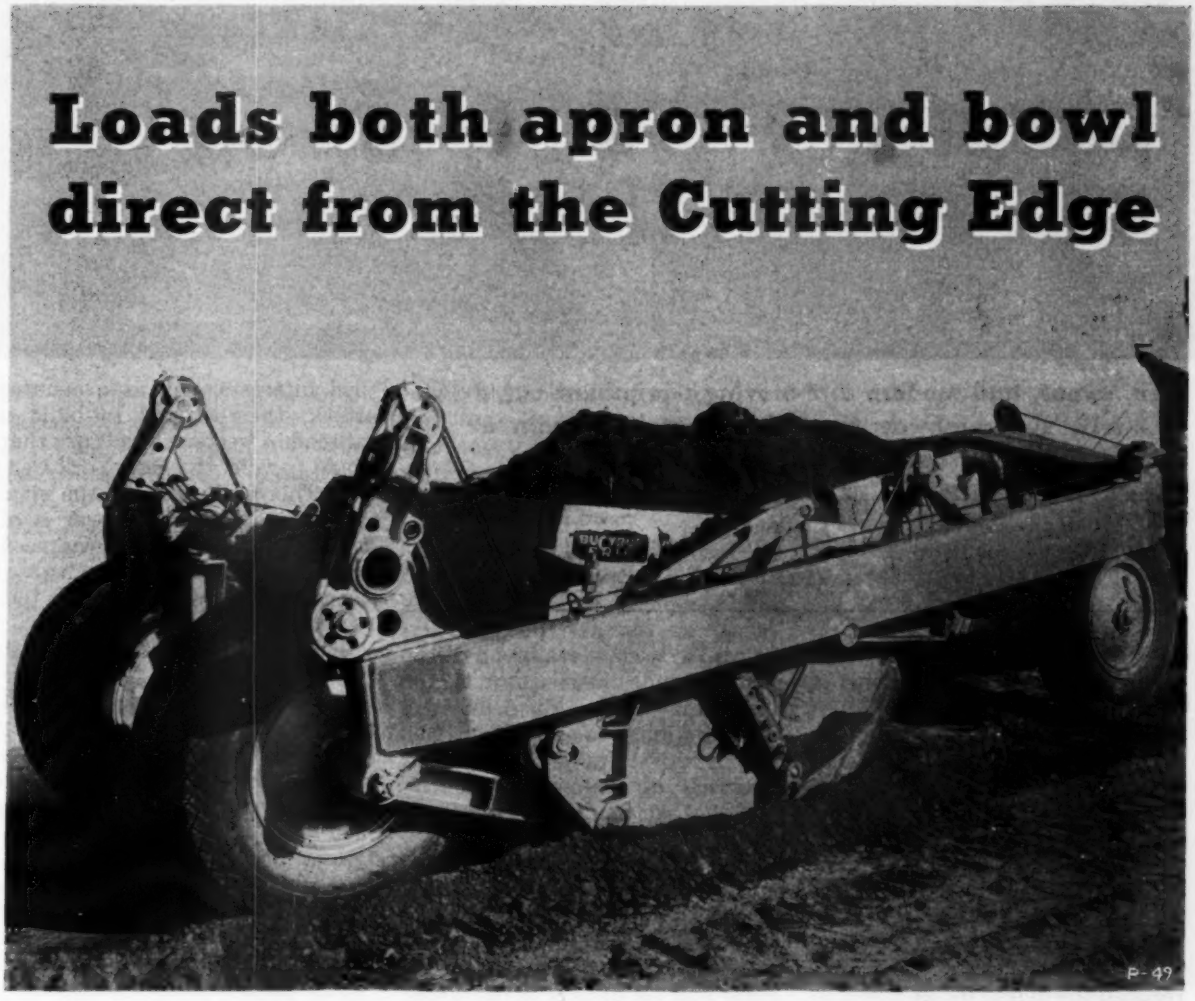
Loads both apron and bowl direct from the Cutting Edge



Easiest Loading Scraper on the Market

Watch a Bucyrus-Erie Scraper BOIL the dirt in. Notice how the material comes up in a single column direct from the cutting edge and then falls over onto the dirt already in the scraper. Notice too how the dirt coming into the scraper falls both ways — forward into the apron and backward into the bowl.

This remarkable boiling action is caused by the patented "double curve" cutting edge, an exclusive Bucyrus - Erie feature. That's why Bucyrus - Eries are the easiest loading scrapers on the market, for no other scraper has a cutting edge that loads with as complete a boiling action as does the Bucyrus-Erie "double curve." Get full information on loading action and other features of Bucyrus-Erie Scrapers from your International Harvester TracTracTor Dealer.

BUCYRUS ERIE

Bucyrus·Erie

SOUTH MILWAUKEE, WISCONSIN

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

Building Pennsylv

Men, sweat, and modern dirt moving equipment cut a 160-mile superhighway through the rocky terrain of Pennsylvania's Appalachian mountains.

PART I

The Story Behind the Job

FOR OVER one hundred years men have been dreaming of an "all-weather" trans-mountain route between Pittsburgh and Harrisburg and now men and modern dirt moving machinery are making that dream a reality with incredible speed.

The realization of the Turnpike dream is closely linked with the South Penn Railroad bubble of the "roaring eighties." In 1883 William H. Vanderbilt, who had reached the height of his power as directing head of the New York Central system, visualized a direct route through the southern tier of the Pennsylvania Alleghenies as an opportunity to extend his lines to the rich Pittsburgh steel district and to gain some of the freight that was exclusively handled by the Pennsylvania Railroad. Upon his decision to make the move he formed a $200,000,000 syndicate and launched construction at once. Grade and tunnel construction was largely done by hand and thousands of workmen toiled along the 209-mile right of way. By the summer of 1885 more than 60 per cent of the grade had been established and a total of about 4½ miles of tunnel had been driven.

● Ri[illegible] the proje[illegible] the Pen[illegible] Turnpike Commission (le[illegible] to right) Charles T. Ca[illegible]enter[illegible] A. Jon[illegible]ut; and [illegible]ow: Arti[illegible]oute shown[illegible]outes

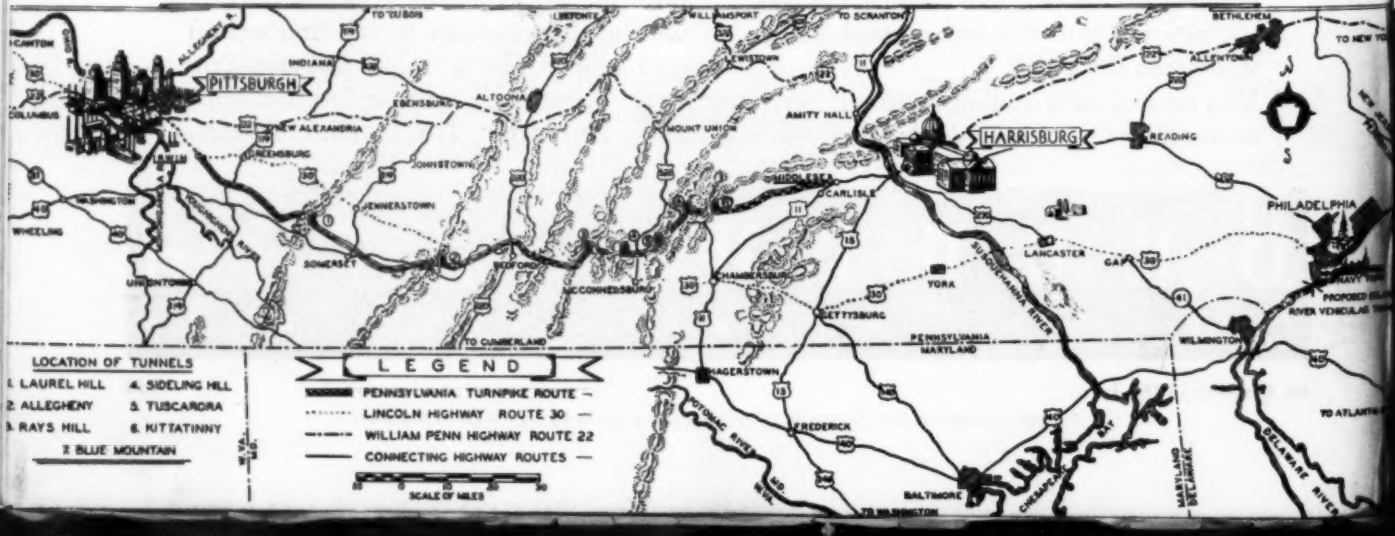
Penn Interests Launch Counter Attack

The railroad building activities of the Vanderbilt group naturally alarmed the Pennsylvania Railroad interests and, as a counter attack, they started to build a railroad in western New York that would parallel the New York Central. This bluff brought the rival factions together for a series of conferences, and peace was soon declared with each group agreeing not to invade the other's territory.

This settlement killed the South Penn Railroad. The "stop work" order came as a complete surprise to the men in the construction camps, tools were laid down one night at the finish of a shift and the following morning the workmen were discharged. Construction camps were closed and the partially finished grade and tunnels were left to the solitude and enveloping undergrowth of the mountain wilderness.

For half a century the ambitious dream of the South Penn Railway route lay dormant until a man mulling over an idea for an "all-weather" highway remembered, from his boyhood days, the abandoned railroad grade and tunnels. The man is Edward Flickinger, chief of city planning in the Pennsylvania Department of Internal Affairs.

Edward Flickinger grew up on a farm near the abandoned route



...nia's "Dream Road"

and during his boyhood often played along the deserted grade and swam in the pool of cool water that collected inside the east portal of Tuscarora Tunnel. During a visit to his old home in the summer of 1933 Flickinger was walking over parts of the old railroad route with his brother when their conversation turned to the huge public-works program that was then being sponsored by the Federal Government and at this point the idea of utilizing the abandoned grade and tunnels of the South Penn Railroad route as a basis for a superhighway from Pittsburgh to Harrisburg was born.

Edward Flickinger carried his scheme back to Harrisburg where it finally reached the ears of the Pennsylvania Planning Board. This Board studied the plan in detail compiling, as it went along, the first connected history of the old railroad route.

Plan Introduced to Pennsylvania's Assembly

The results of this brief investigation were favorable and in 1936 Cliff S. Patterson, representative of Washington County in the Pennsylvania Assembly, introduced a resolution authorizing a joint legislative commission of five to complete the investigation into the merits of the proposed superhighway. In May, 1937, the resolution was unanimously passed and the Pennsylvania Turnpike Commission formed. Upon the commission's recommendation funds were obtained from the Works Progress Administration and the Pennsylvania Department of Highways to finance a survey of the right of way.

The survey, under the direction of H. H. Temple, chief engineer of the highway department, worked ten crews a total 72,000 man-hours over a period of thirteen months. The old route was ferreted out and profiles and cross sections were plotted. Results of the survey definitely established the feasibility of constructing a superhighway through the Appalachian mountains and the five-man Turnpike Commission made up of Walter A. Jones, Chairman; Frank Bebout; Charles T. Carpenter; Thomas J. Evans; and I. Lamont Hughes, Secretary of Highways and ex-officio member of the commission, was faced with the problem of raising the $61,100,000 necessary to construct the trans-mountain Turnpike.

Mr. Jones, Commission Chairman, proved himself a star salesman at this point by inducing President Roosevelt, Secretary of Interior Harold Ickes, and Chairman Jesse Jones of the RFC to aid in financing Pennsylvania's Turnpike. Stressing the national military value of the superhighway, Chairman Jones obtained an outright grant of $26,100,000 from the PWA and sold the commission's bonds for the remaining $35,000,000 to the RFC.

First Dirt Is Moved

Upon the acquisition of these funds the commission lost no time in advertising and letting bids for Turnpike construction and in November, 1938, the first earth was moved. From then on grading, drainage, and tunnel contracts were awarded in rapid succession to the qualified low bidders until in July, 1939, these contracts were all awarded. Paving contracts closely followed the grading

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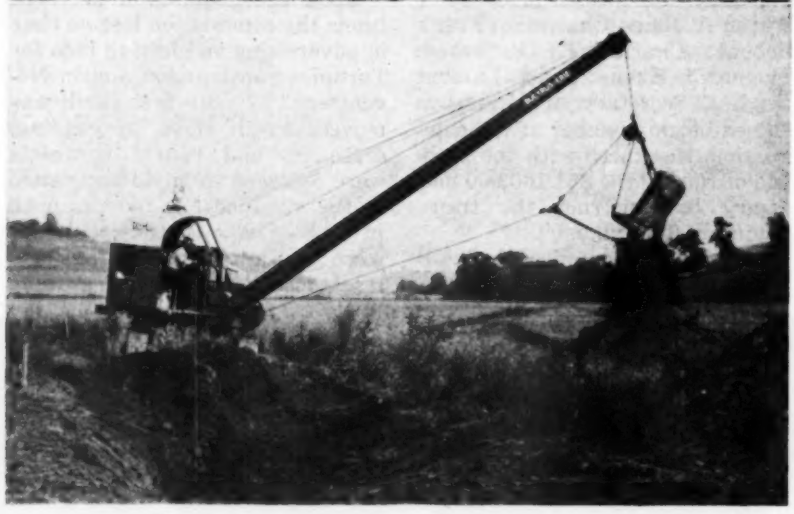


● Top: A roaring Diesel truck throws out a cloud of fine blue smoke as it dumps its load on a G-M-P fill while a Cat-mounted LeTourneau stands by to spread the load. Center: A Caterpillar elevating grader loads to Euclid wagons on the G-M-P contract. Bottom: G-M-P Bucyrus-Erie 10-B dragline puts in a protective drainage ditch along the side of the Turnpike.

and drainage contracts and were let in the same manner.

Pennsylvania's "dream road" is being built over a 200-foot right of way, graded 78 feet wide throughout with the exception of seven tunnel sections which are 28 feet wide. Three per cent grades and six degree curves have been fixed by the commission as maximum for the Turnpike. From slope line to slope line on fills a typical road section consists of two 10-foot berms, two 24-foot concrete roadways providing four 12-foot traffic lanes, and a 10-foot separating strip in the center. In cuts, which range as deep as 150 feet, the section remains the same with the exception of the berms which are 7 feet with 3-foot drainage ditches on the outside.

Traffic in the seven tunnels will be carried by two 12-foot lanes. Taking their name from mountains they pierce, the 6½ miles of Turnpike tunnels are in order from West to East; Laurel Hill, Allegheny Mountain, Rays Hill, Sideling Hill, Tuscarora Mountain, Kittatinny Mountain, and Blue Mountain. By using seven of the original nine railroad tunnels the Turnpike Commission saved considerable expense as the old railroad bores were about half completed and needed only to be enlarged to Turnpike specifications.

Turnpike borings will be sufficiently large to permit a free-way of at least 23 feet in width and 14 feet in height inside the tunnel after the lining and ventilation ducts have been placed. Thickness of the concrete lining will vary according to the nature of the rock strata through which the bores pass.

Old Railroad Bores Wisely Driven

The wisdom of the early railway engineers in selecting their tunnel sites in narrow sections of the mountains beneath saddles and oriented as far as possible to the normal strike or trend of the strata has been recognized by the Turnpike's geologists who have closely examined the old tunnel sites and found them in excellent condition.

Turnpike tunnel contracts call for the enlarging and reshaping of the old railroad bores, driving of the unfinished portions, and the

installation of concrete tunnel linings and floors, complete with ventilation, drainage, and power. Typical cross section plans show the inlet ventilation ducts in the upper portion of the tunnels between the roof and ceiling, outlet ducts at the edges of the pavement, drainage galleries at each side along the tunnel walls, sidewalls, and high and low tension ducts. Provision is being made for a later installation of tile or structural glass over the concrete lining.

With the exception of Rays Hill each tunnel will have two ventilation buildings, one at each portal. As the Rays Hill tunnel is only 3,419 feet long only one ventilation building, located at the West portal, will be necessary to provide sufficient ventilation for the entire length. Two huge fans are to be installed in each ventilation building, which will be of native stone construction forming part of the tunnel portals. Each building is to be four stories with reinforced concrete floors and composition roof.

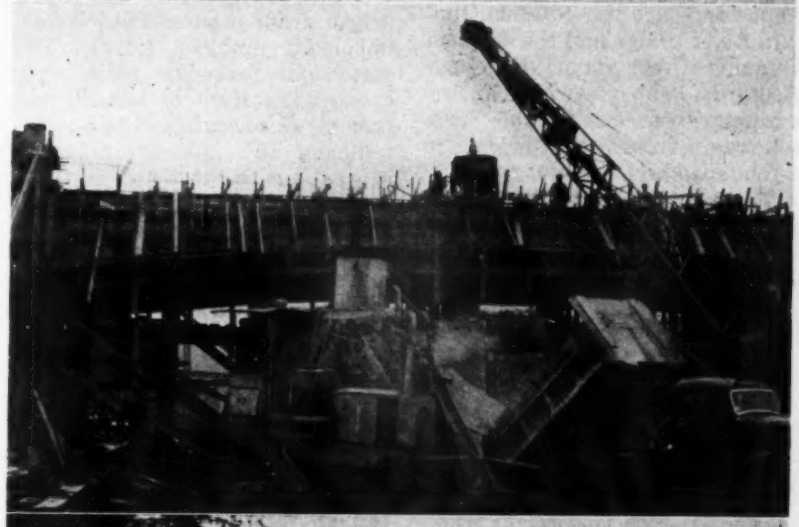
Completed tunnels will be equipped with normal and emergency electric lighting systems, telephone and signal systems, stationary and portable fire-fighting appatus and other devices for safety and efficiency in operation after completion.

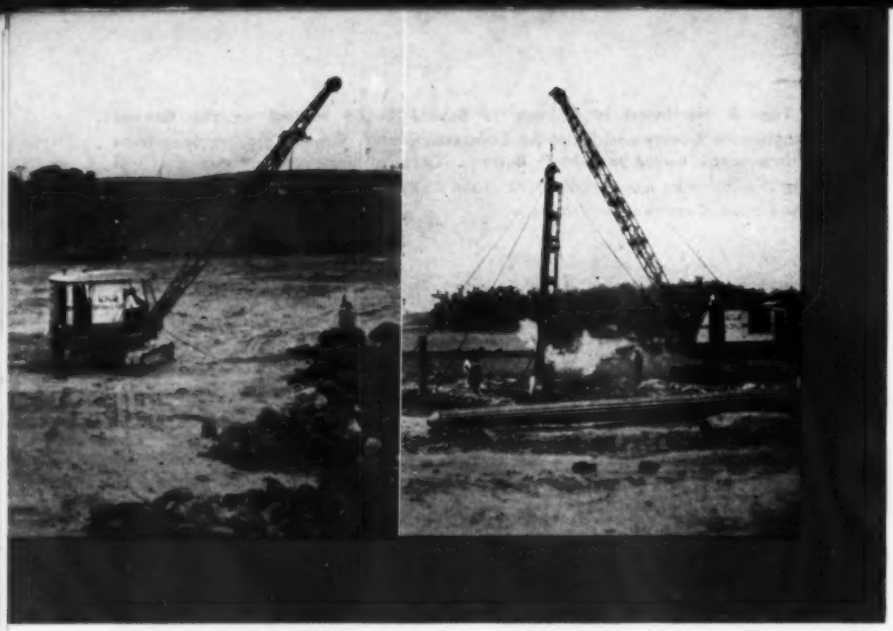
Turnpike Follows Highland Route

Outstanding feature of the general route of the Turnpike is its highland location along the watershed between the Potomac and Susquehanna River drainage areas. Although excavation costs were somewhat increased by following this route drainage structure costs were greatly lowered, effecting a general saving. Even though streams are more numerous in the highlands than in the big valleys, they are also smaller, and most of them were bridged by box or arch culverts. Of the 139 drainage structures on the Turnpike only 29 are over 25 feet, and only 14 are over 50 feet in span.

Largest of the major structures is the 600-foot New Stanton viaduct in Westmoreland County. This imposing structure of reinforced concrete will span a 1400-foot valley 60 feet above the valley

● **Top: A Northwest loads rock to 8-yard Euclid wagons on the Central Pennsylvania Quarry and Stripping Contract. Center: Cement placing operations on an overpass award to G-M-P. Bottom: A typical large concrete arch that will carry the Turnpike over Brush Creek. John F. Keelor subcontracted this structure from Empire Construction Company.**





● Left: Swinging a 4,000 pound "skull cracker" this Bucyrus-Erie 19-B breaks up large oversize on the G-M-P contract. Right: G-M-P's Bucyrus-Erie 37-B rigged up as a pile driver puts in piles for a floating arch.

floor, and will carry the Turnpike over two highways, a railroad, and the Sewickley Creek. Closely following the New Stanton viaduct in importance are the 500-foot Juniata River bridge and the 425-foot Dunnings Creek viaduct both near Bedford, Pennsylvania. The remaining structures on the Turnpike range from 90-foot bridges to 6-foot span arch culverts.

To assure an "all-weather" route the course of the highway runs largely along the southern and western sides of the hills so that the sun may aid in clearing the road of snow and ice.

Grade Separations Along Entire Route

Since no intersecting roads will cross the Turnpike for its entire length grade separations were an important problem. Of the 180 state and township roads that crossed the right of way it was possible to relocate and vacate 40, reducing the number of grade separations to 140. Three of these are provided for under viaducts, the remaining 137 requiring special structures. In addition, there are four railroad and two trolley crossings and a small number of private crossings.

Eighty of the highway grade separation structures are overhead and 57 under Turnpike grade. Ten interchanges are spaced along the Turnpike route at intervals of about 20 miles to allow traffic to enter and leave the highway. Toll stations will be erected at these points as well as at each end of the Turnpike.

The story of the actual construction of the Turnpike is a colorful one. Private contractors from all over the United States hold the 45 major excavation contracts that call for the handling of 21,000,000 yards in cuts and fills and the removal of about 700,000 yards of rock from the seven tunnels. The letting of the first contract in November, 1938, marked the start of a constant stream of men and machinery through the peaceful Appalachian Mountains. The steady, staccato beat of gasoline and diesel powered motors pervades the quiet countryside and the shouts of men at work ring out once more along the old railroad grade.

PART II

Digging Scenes Along the Turnpike

A trip along the line of Turnpike construction is a constant succession of memorable scenes. Completing grading and drainage for one mile of the rugged and rocky terrain costs as much as five miles of ordinary highway. Along the entire route modern dirt moving equipment is meeting the test and making Pennsylvania's "dream road" possible.

Starting at Irwin, the western terminal of the Turnpike, the first contract visited* was that of the McCrady Construction Company. Working along a comparatively level stretch of right of way a group of four 12-yard LeTourneau scrapers pulled by Caterpillar RD-8 tractors were building up the grade. A Caterpillar-mounted LeTourneau bulldozer was spreading out the fill which in turn was rolled by two Hubers and one Buffalo-Springfield roller. As was the case in many of the contracts visited, the McCrady Company had just moved in and the greater part of their work lay before them. Subbing on this contract, Wagman & Wagman, Dallastown, Pennsylvania, have the grading and drainage for the intersection with U. S. Highway 30 as well as two overpasses not far from the end of the Turnpike.

The next contract (1.38 miles involving $415,736.70) is held by Baldwin Bros. Paving Company who received their contract on July 6, but were not yet underway, being occupied with moving in equipment.

Two contracts held by Ferguson & Edmunson Company, 14.33 miles of grading, drainage and structures, were under way with subcontractor Conte Eastwood operating three Lorains, one 80 and two 77's, loading to 8-yard Euclid Trac-Truks. Eight scrapers (three 12-yard LeTourneaus pulled by

* Editor's Note: The following paragraphs are in description of the various contracts visited on a 15-day trip by staff members along the route of Turnpike construction. A complete listing of the contracts is published on page 560. Equipment mentioned consists of the machinery seen in action on the job and is not to be taken as a complete listing.

Caterpillar Tractors and five 8-yard Austin-Westerns) were also busy at this point. The scrapers and shovels handled an estimated ten to 12,000 yards per day with varying lengths of haul. This same contractor (Ferguson and Edmundson Company) also have the new Stanton Viaduct on their bid of $364,864.81, as mentioned above the largest of the major structures on the Turnpike.

G-M-P Tackles Tough Rock Cuts

Moving eastward, the first scene of full-blast activity was found on Guthrie - Marsch - Peterson Company's two contracts involving 8.3 miles of "structures, grading and drainage." One of the cuts in progress is known as "Mount Joy" —rated the third largest on the Turnpike. G-M-P was busy blasting and digging about 680,000 yards of material that was 70% hard sandstone and limestone out of a cut 97 feet in depth and 300 feet wide.

Jim Garrison is the company's superintendent on the job and Fred Riggs is shovel foreman on the big cut. Plenty of blasting was necessary in this area and under the capable supervision of old-timer Jim Blakley, blasting foreman, the drilling and shooting operations were carried on one jump ahead of the shovels.

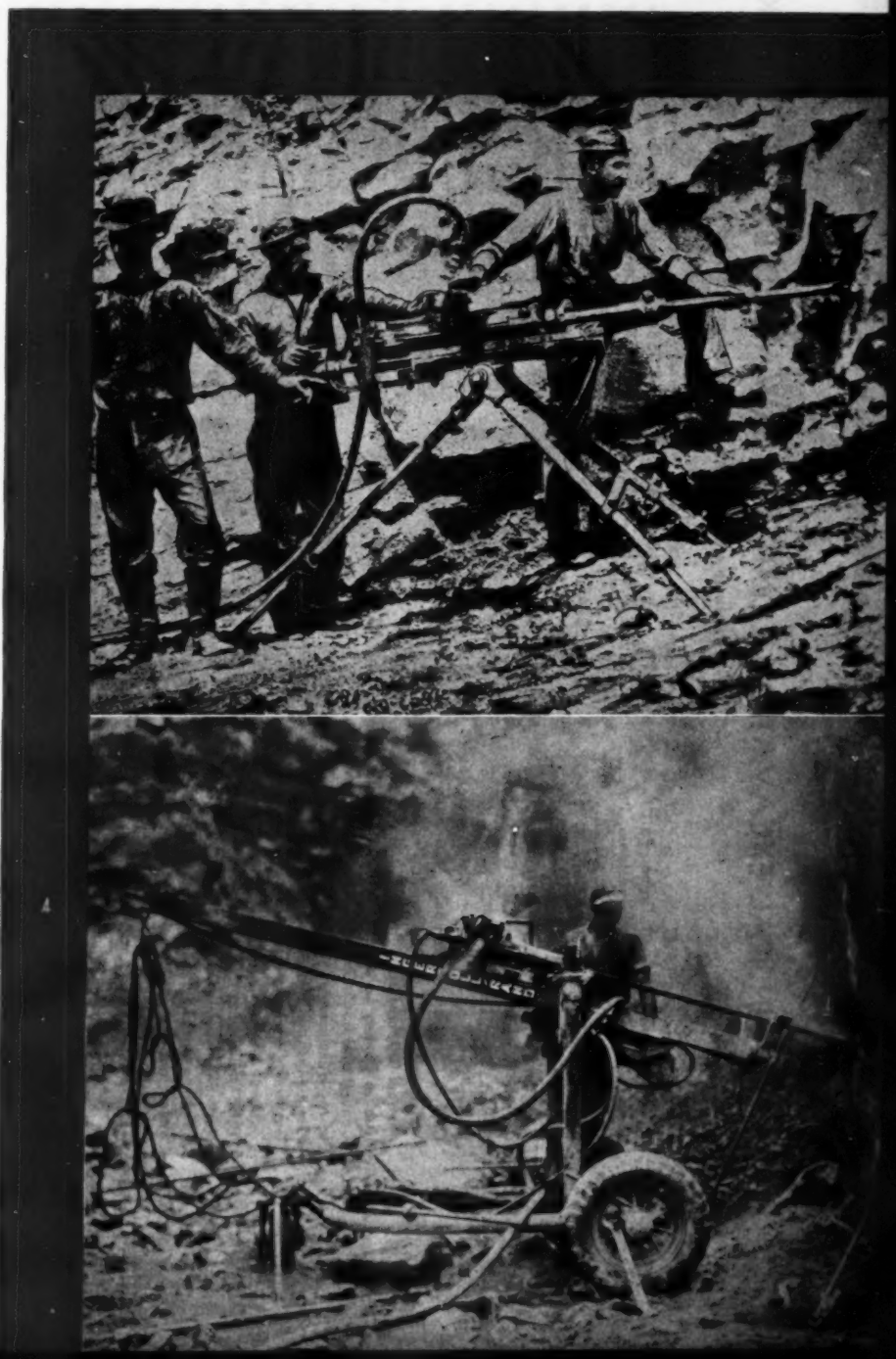
Using Timken detachable bits on four Ingersoll-Rand wagon drills powered by four Ingersoll-Rand compressors the G-M-P drilling gang put down 60 to 80 twelve foot holes per 7-hour shift in hard sandstone. The holes were loaded with Atlas powder of 40% gelatine content and detonated with No. 6 electric blasting caps. Spaced 6-feet apart 700 to 800 holes, containing 7,000 to 8,000 pounds of powder, are fired per blast. At the rate of about one blast per day it is estimated that about 200,000 pounds of powder will be necessary to break up the rock in the 97 foot cut.

Busy loading out the broken rock were two 2½-yard Northwests and one 3-yard Marion. Eleven Diesel-powered Euclids of 9.7 yards capacity hauled the heavy rock to a 70-foot fill. At this point a Bucyrus-Erie 19-B crane was busy swinging a 4,000 pound "skull cracker" on the large oversized rocks dumped by the trucks. This operation saved the trouble of secondary blasting and broke up the rock to suitable size for fill. Also working on the 280,000 yard fill was a Caterpillar-mounted LeTourneau bulldozer that dished up the big rocks for the 19-B and kept the road to the fill open for the trucks.

The next stop along the Turnpike was a visit to "Mashudaville," construction and maintenance camp of Frank Mashuda who brought his "top" men and equipment from Milwaukee, Wisconsin to handle 4.10 miles of tough digging on his $582,711 contract. Housing and feeding about 45 men, Mr. Mashuda's camp is one of the few complete construction camps on the Turnpike.

At the time of our visit the Mashuda contract was about 40%

(Continued on Page 576)



● **Top: Over 50 years ago drilling crews of the type shown drove the bore of the old Penn railroad tunnels. Bottom: "Snake holing" in the modern manner with an Ingersoll-Rand wagon drill on the west portal of the Sideling Hill tunnel.**

UMI

PRINCIPAL EXCAVATION CONTRACTS AWARDED BY THE TURNPIKE COMMISSION

(This table is a key to the Turnpike map inserted in this issue)

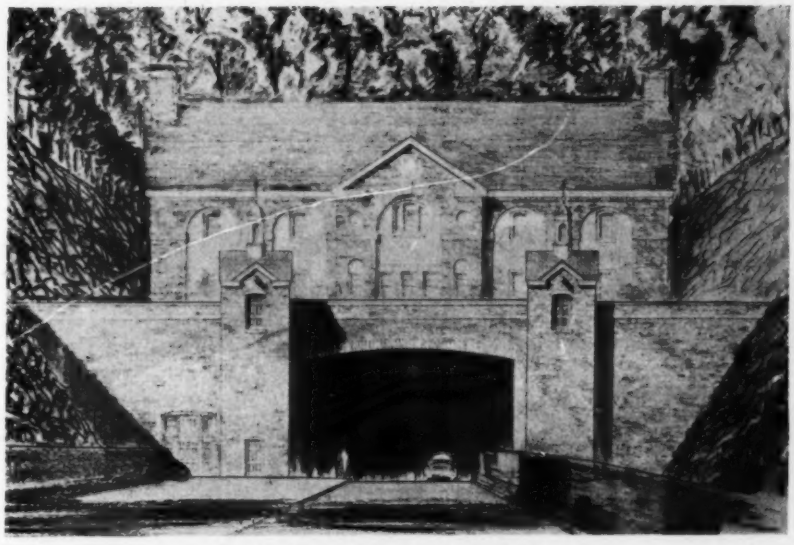
Contract No.	Contractor	Section	Date Awarded	Amount of Contract	Type of Construction	Calendar Days	Length in Miles
1	L. M. Hutchison, Mount Union, Pa.	19	10-27-38	$ 458,058	Structures Grading and Drainage	275	9.54
2	Girard Const. Co., Inc., Philadelphia, Pa.	11, 12	11-29-38	444,758	Structures Grading and Drainage	230	9.56
3	C. T. Burket, Vineland, N. J.	19-A	12-20-38	115,627	Structures Grading and Drainage	220	0.69
4	Connell and Laub, Dayton, Ohio	7-B, 8-A	1- 4-39	605,113	Structures Grading and Drainage	200	6.70
5	M. Edward Wilt and Sons, Millersburg, Pa.	19-B	2-17-39	29,884	Structures Grading and Drainage	135	0.247
6	C. J. Langenfelder & Son, Rosedale, Balto. Co., Md.	15, 16	2-17-39	418,813	Structures Grading and Drainage	180	6.91
7	Guthrie-Marsch-Peterson Co., Chicago, Ill.	4	3- 1-39	505,091	Structures Grading and Drainage	250	1.78
8	Nello L. Teer, Durham, N. C.	15-A	3-14-39	132,495	Structures Grading and Drainage	100	2.924
9	Empire Construction Company, Baltimore, Md.	13, 14	3-14-39	773,918	Structures Grading and Drainage	225	5.452
10	County Construction Company, Carnegie, Pa.	8-C, 9-A	3-20-39	663,164	Structures Grading and Drainage	130	7.55
11	McCrady Const. Co., Pittsburgh, Pa.	2	6- 7-39	354,072	Structures Grading and Drainage	120	2.88
12-S2	Arundel Corporation, Baltimore, Md.	S2	4- 3-39	2,444,527	Sideling Hill Tunnel and East and West Approaches	315	2.526
13-L2	Hunkin Conkey Construction Co., Cleveland, Ohio	L2, L2	4- 3-39	1,920,281	Laurel Hill Tunnel and East and West Approaches	315	2.39
14	Connell and Laub Construction Co., Dayton, Ohio	8B-2	4-27-39	240,532	Structures Grading and Drainage	100	3.05
15	L. M. Hutchison, Mount Union, Pa.	16-A, 17	4-27-39	429,781	Structures Grading and Drainage	115	5.54
16	Frank Mashuda, Milwaukee, Wis.	4-A	4-27-39	582,711	Structures Grading and Drainage	100	4.10
17	Guthrie-Marsch-Peterson Co., Chicago, Ill.	A2	5-12-39	2,672,188	Allegheny Tunnel and East and West Approaches	315	1.86
18	Bates and Rogers, Chicago, Ill.	KB2	5-12-39	2,920,123	Kittatinny and Blue Mt. Tunnel and East and West Approaches	315	2.348
20	York Engineering Co., York, Pa.	13-B	5- 4-39	326,209	Viaduct and Grading and Drainage	200	0.77
21	York Engineering Co., York, Pa.	13-C	5- 4-39	315,406	Structures Grading and Drainage	115	2.47
23	Ferguson and Edmondson Co., Pittsburgh, Pa.	3-B	5-12-39	364,864	New Stanton Viaduct Grading and Drainage	160	0.36
24	Mason and Hanger Co., New York City	R-2	5-24-39	1,549,718	Rays Hill Tunnel and East and West Approaches	295	1.33
25	B. Perini and Sons, Inc., Framingham, Mass.	T-2	5-24-39	2,055,939	Tuscarora Tunnel and East and West Approaches	295	2.05
26	Guthrie-Marsch-Peterson Co., Chicago, Ill.	3-A, 4-C	5-24-39	709,957	Structures Grading and Drainage	130	6.52
27	N. R. Corbisello, Binghamton, N. Y.	13-E	7-20-39	882,710	Structures Grading and Drainage	210	0.96
28	M. Bennett & Sons, Indiana, Pa.	12-B, 13-A	5-24-39	496,532	Dunning Creek Viaduct Grading and Drainage	200	1.293
29	C. J. Langenfelder & Son, Rosedale, Md.	18	6- 7-39	731,466	Structures Grading and Drainage	120	9.54
32	Ferguson and Edmondson Co., Pittsburgh, Pa.	2-B, 3A1	6- 7-39	489,540	Structures Grading and Drainage	120	4.33
33	Adam Eidemiller, Greensburg, Pa.	5-A	6- 7-39	699,588	Structures Grading and Drainage	120	5.29
34	George Vang, Inc., Pittsburgh, Pa.	5, 6	6- 7-39	616,596	Structures Grading and Drainage	100	5.52
35	N. B. Putman Co., Harrisburg, Pa.	11-B	6-19-39	164,955	Structures Grading and Drainage	100	0.113
36	H. R. Dickens, Philadelphia, Pa.	8C1, 9A1	6-19-39	138,466	Structures Grading and Drainage	90	0.28
37	Dalton Bros., Inc., Paoli, Pa.	16-B	6-19-39	234,593	Structures Grading and Drainage	90	1.96
38	H. W. Shaull & Son, Mechanicsburg, Pa.	18A, 19C	6-19-39	287,833	Structures Grading and Drainage	100	4.92
39	Walker Bros., Chambersburg, Pa.	19-D	7-20-39	886,027	Paving Contract Structures—Grading R. C. Pavement	175	10.28
40	Baldwin Bros. Paving Co., Cleveland, Ohio	2-C	7- 6-39	415,736	Structures Grading and Drainage	110	1.38
41	Central Pa. Quar. Strip. & Const. Co., Hazleton, Pa.	9C2, 10, 11A	7- 6-39	1,561,920	Structures Grading and Drainage	165	7.27
42	Connell & Laub Const. Co., Dayton, Ohio	8B-1	7- 6-39	642,295	Structures Grading and Drainage	150	2.75
43	Herman Holmes, Crystal Falls, Mich.	12A	7-20-39	1,513,504	Structures Grading and Drainage	150	7.13
44	Nello L. Teer, Durham, N. C.	13D	7- 6-39	795,244	Structures Grading and Drainage	140	3.38
45	Holt-McConnel & Osburn, Connonsburg, Pa.	15B	7-20-39	52,222	Structures Grading and Drainage	100	0.335
46	John H. Swanger, Lancaster, Pa.	19E, 20	8- 1-39	1,114,324	Paving; Structures Grading and Drainage	260	6.70
47	Johnson, Drake and Piper, Inc., Freeport, L. I.	20A	8- 1-39	1,213,588	Paving; Structures Grading and Drainage	250	5.38
48	L. M. Hutchison, Mount Union, Pa.	14A	8- 1-39	487,420	Structures Grading and Drainage	220	2.72
49	Shullo Const. Co., Akron, Ohio	7P1, 8P1	8- 1-39	681,650	R. C. Pavement, Grading	270	7.87
50	Union Paving Company, Philadelphia, Pa.	8P4, 9P1		730,711	R. C. Pavement, Grading	270	8.12

NOTE: Feet and Miles of Construction Pertains Only to Turnpike Distances and Not Distances for Side-Road Construction Which is Included in Amount of Contract.

A Folio of

MAPS AND SKETCHES

on the Pennsylvania Turnpike



● Sketch of tunnel entrance structure on the Pennsylvania Turnpike. Located at each tunnel portal, these buildings will house light and ventilation facilities for the tunnels.

This detachable 8-page folder features a full-sized map of Pennsylvania's "Dream Road" showing size and location of the individual contracts. The other sketches include a typical cut and fill section, a drawing of a tunnel cross section, size comparison of the old railroad bore and the new highway tunnel, and a profile view of the twin tunnels (Kittatinny and Blue Mountain) showing the old railroad bore and distance to be driven.

NOTE: Feet and Miles of Construction Pertains Only to Turnpike Distances and Not Distances for Side-Road Construction Which is Included in Amount of Contract.

UMI

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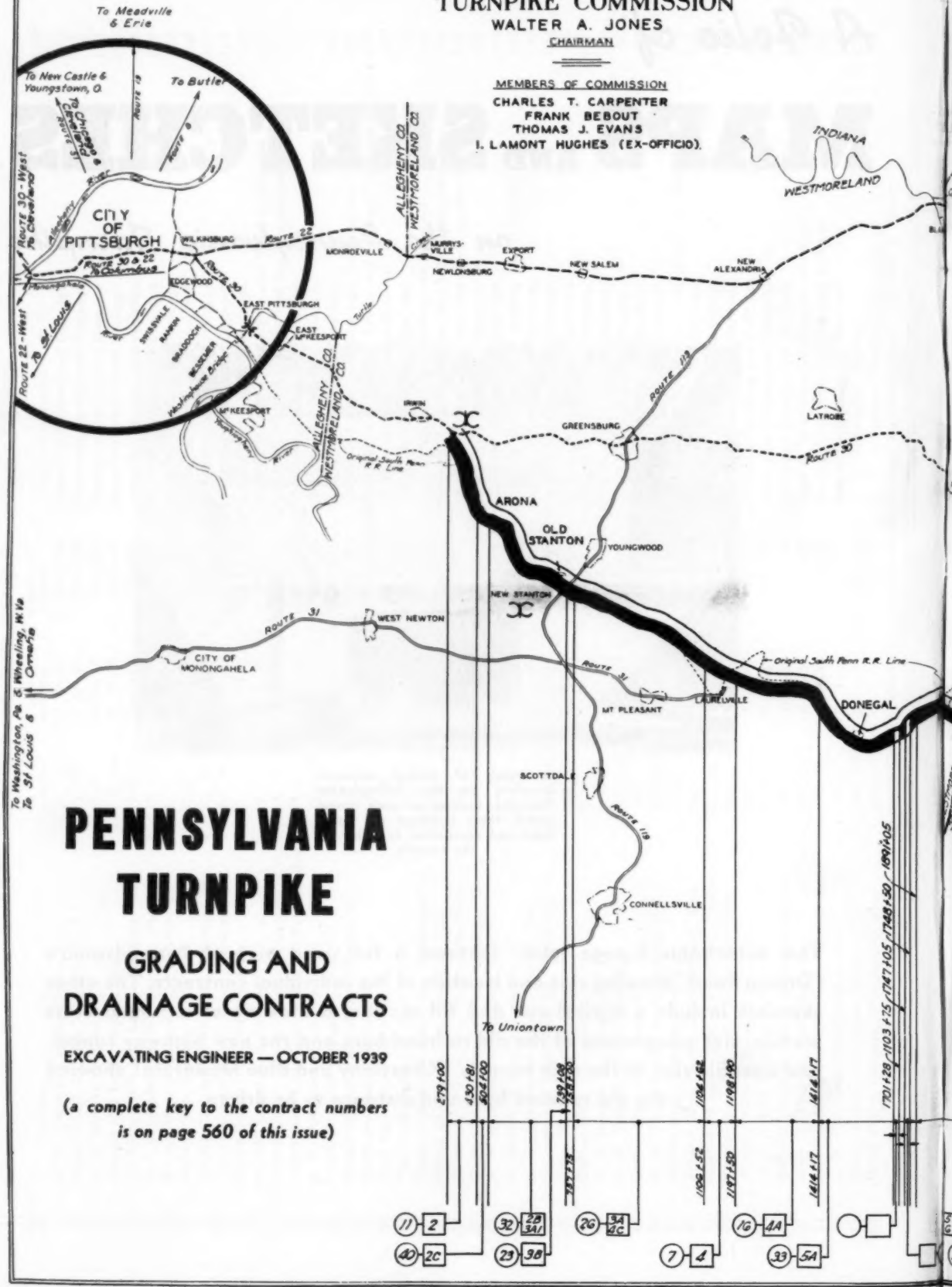
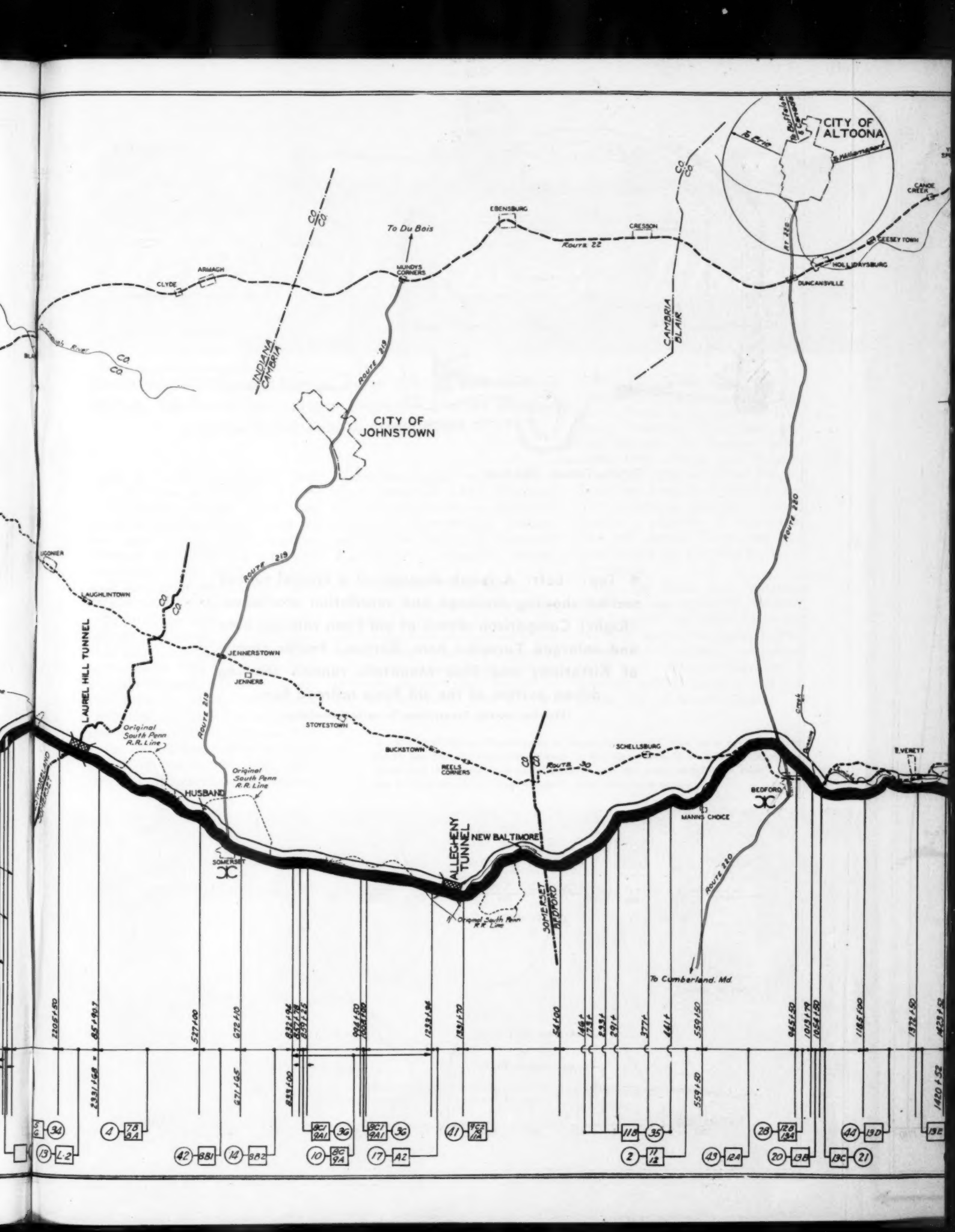


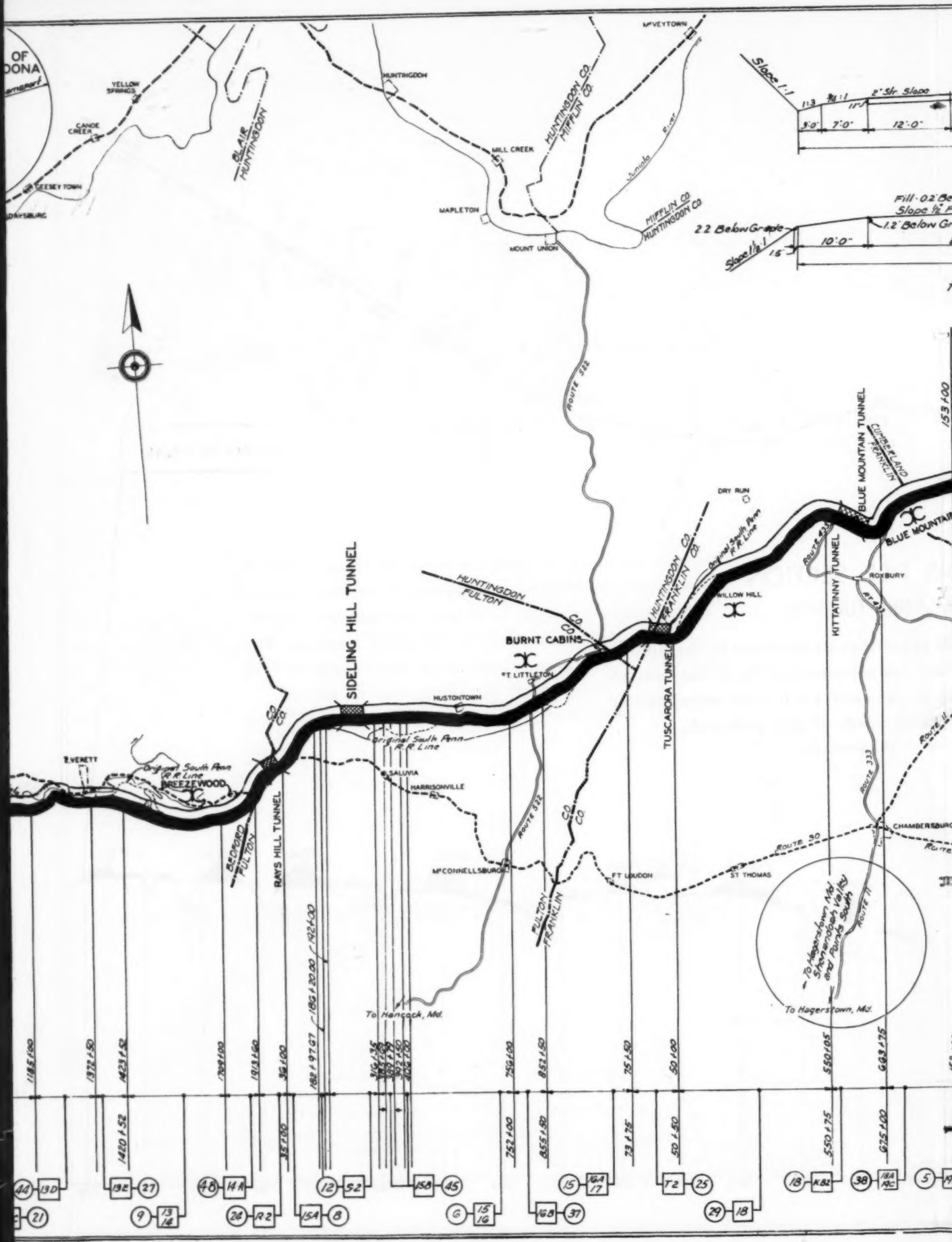
PENNSYLVANIA TURNPIKE

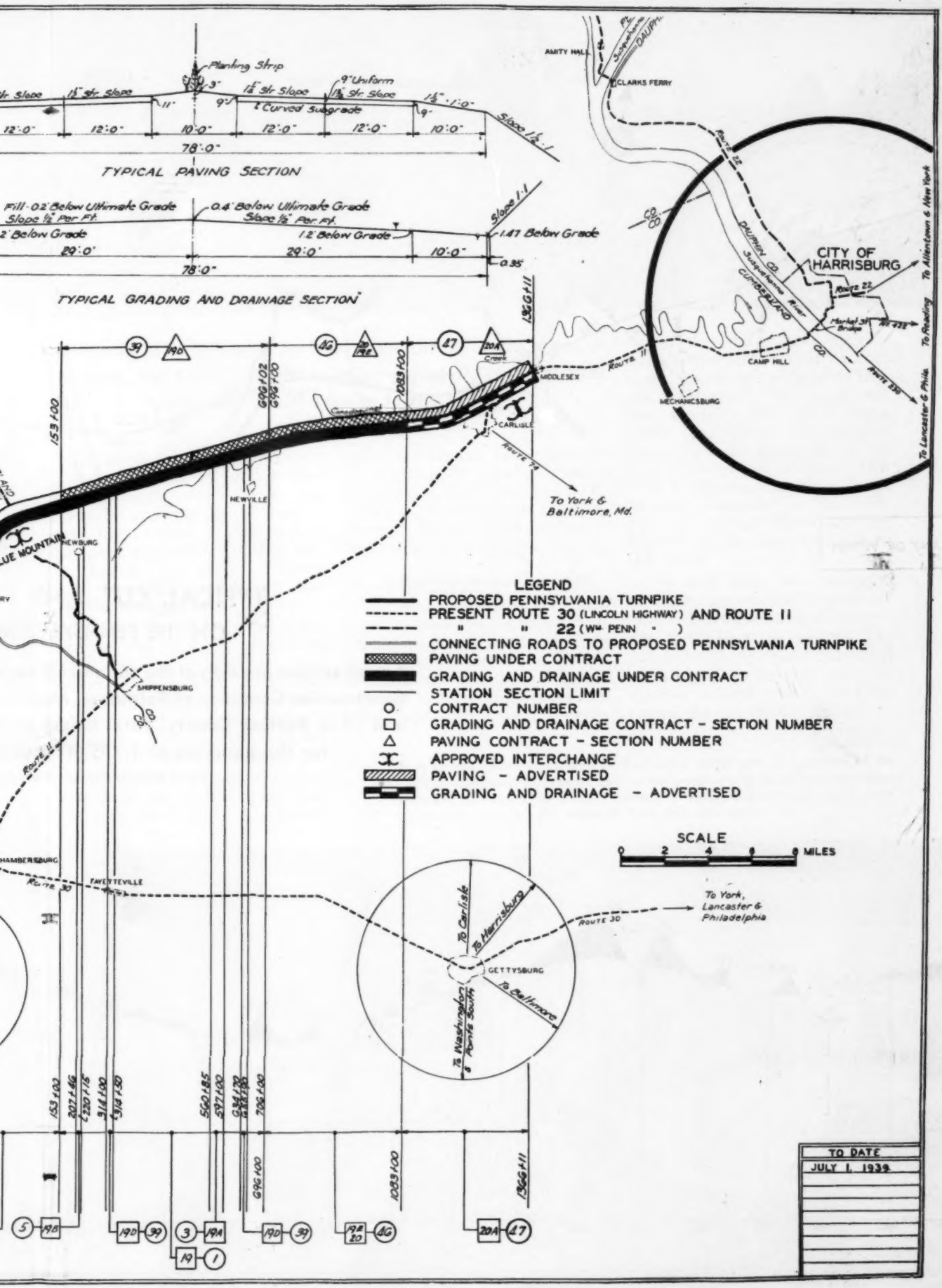
GRADING AND DRAINAGE CONTRACTS

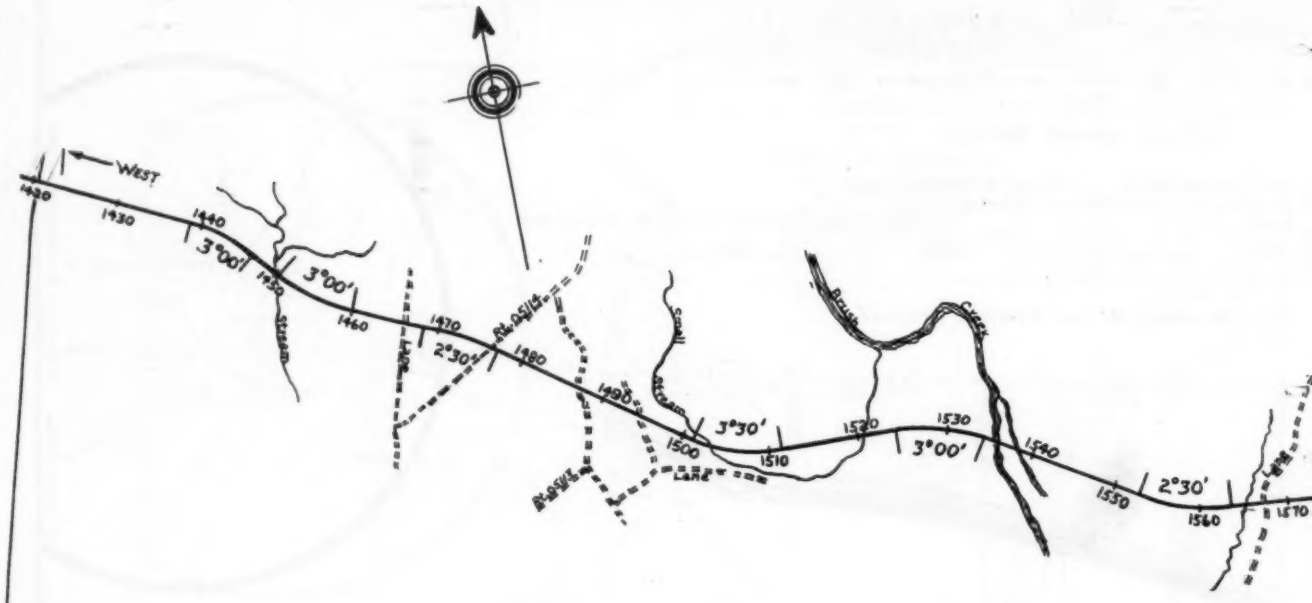
EXCAVATING ENGINEER — OCTOBER 1939

(a complete key to the contract numbers is on page 560 of this issue)


CITY OF ALTOONA
To Du Bois
EBENSBURG
CRESSON
Route 22
CANOE CREEK
HOLLIDAYSBURG
DUNCANSVILLE
CLYDE
ARMAGH
MUNDYS CORNERS
INDIANA CAMBRIA
CAMBRIA BLAIR
Route 219
CITY OF JOHNSTOWN
Route 220
LAUGHLINTOWN
LAUREL HILL TUNNEL
JENNERSTOWN
JENNERS
Original South Penn R.R. Line
STOYESTOWN
BUCKSTOWN
REELS CORNERS
Route 30
SCHELLSBURG
HUSBAND
SOMERSET
NEW BALTIMORE
ALLEGHENY TUNNEL
BEDFORD
MANNS CHOICE
To Cumberland, Md
SOMERSET
BEDFORD


YELLOW SPRINGS
CANOE CREEK
BLAIR HUNTINGDON
HUNTINGDON
MILL CREEK
HUNTINGDON CO
MIFFLIN CO
Juniata River
McVEYTOWN
MAPLETON
MOUNT UNION
MIFFLIN CO
HUNTINGDON CO
Slope 1:1
2' Str. Slope
9'-0"
7'-0"
12'-0"
2.2 Below Grade
10'-0"
Slope 1½:1
ROUTE 522
BLUE MOUNTAIN TUNNEL
CUMBERLAND
FRANKLIN
DRY RUN
HUNTINGDON CO
FRANKLIN CO
Original South Penn R.R. Line
ROUTE 433
ROXBURY
WILLOW HILL
HUNTINGDON
FULTON CO
BURNT CABINS
PT LITTLETON
SIDELING HILL TUNNEL
HUSTONTOWN
TUSCARORA TUNNEL
KITTATINNY TUNNEL
ROUTE 333
ROUTE 11
CHAMBERSBURG
ROUTE 30
ST THOMAS
FT LOUDON
McCONNELLSBURG
FULTON
FRANKLIN
To Hancock, Md.
To Hagerstown, Md. Shenandoah Valley and Points South
To Hagerstown, Md.
EVERETT
Original South Penn R.R. Line
BREEZEWOOD
BEDFORD
FULTON
RAYS HILL TUNNEL
SALUVIA
HARRISONVILLE
1185+80
1372+50
1423+52
1420+52
1924+00
1911+60
36+00
35+80
1821+97.67
1861+20.00
1924+00
896+35
752+00
855+50
75+50
50+00
550+85
550+75
682+75
625+00
153+00
44
19D
19E
27
21
9
13/14
48
14A
24
R2
12
52
15A
8
15B
45
G
15/16
15
16A/17
16B
37
T2
25
29
18
18
K82
38
18A/A2C
5


Planting Strip
3"
1½" Str. Slope
9" Uniform
1½" Str. Slope
1½" Str. Slope
1½" Str. Slope
11'
9"
9"
1½":1'-0"
Curved Subgrade
12'-0"
12'-0"
10'-0"
12'-0"
12'-0"
10'-0"
78'-0"
Slope 1½:1
TYPICAL PAVING SECTION
Fill-0.2' Below Ultimate Grade
Slope ½" Per Ft.
0.4' Below Ultimate Grade
Slope ½" Per Ft.
Slope 1:1
1.2' Below Grade
1.2' Below Grade
1.47 Below Grade
29'-0"
29'-0"
10'-0"
0.35
78'-0"
TYPICAL GRADING AND DRAINAGE SECTION
AMITY HALL
CLARKS FERRY
Ft. Johnstown
DAUPHIN
Route 22
CO.
CO.
DAUPHIN CO.
Susquehanna River
CUMBERLAND CO.
CITY OF HARRISBURG
Route 22
To Allentown & New York
To Reading
Market St. Bridge
Route 11
CAMP HILL
CO.
Route 230
To Lancaster & Phila.
MECHANICSBURG
MIDDLESEX
CARLISLE
Route 74
To York & Baltimore, Md.
NEWVILLE
NEWBURG
SHIPPENSBURG
CO.
Route 11
HAMBERSBURG
Route 30
FAYETTEVILLE
To York, Lancaster & Philadelphia
Route 30
To Carlisle
To Harrisburg
GETTYSBURG
To Baltimore
To Washington & Points South
153+00
207+46
220+78
314+00
314+30
560+85
597+00
634+32
696+00
706+00
1033+00
1366+11
LEGEND
PROPOSED PENNSYLVANIA TURNPIKE
PRESENT ROUTE 30 (LINCOLN HIGHWAY) AND ROUTE 11
" " 22 (WM. PENN -)
CONNECTING ROADS TO PROPOSED PENNSYLVANIA TURNPIKE
PAVING UNDER CONTRACT
GRADING AND DRAINAGE UNDER CONTRACT
STATION SECTION LIMIT
CONTRACT NUMBER
GRADING AND DRAINAGE CONTRACT - SECTION NUMBER
PAVING CONTRACT - SECTION NUMBER
APPROVED INTERCHANGE
PAVING - ADVERTISED
GRADING AND DRAINAGE - ADVERTISED
SCALE
0 2 4 6 8 MILES
TO DATE
JULY 1, 1939



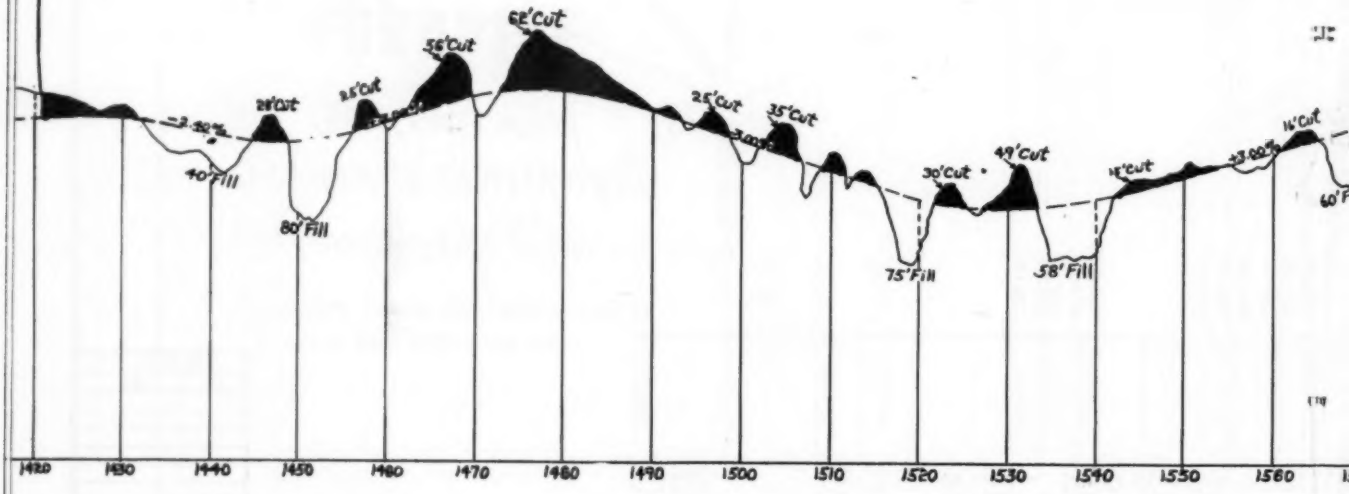
LIMIT OF WORK

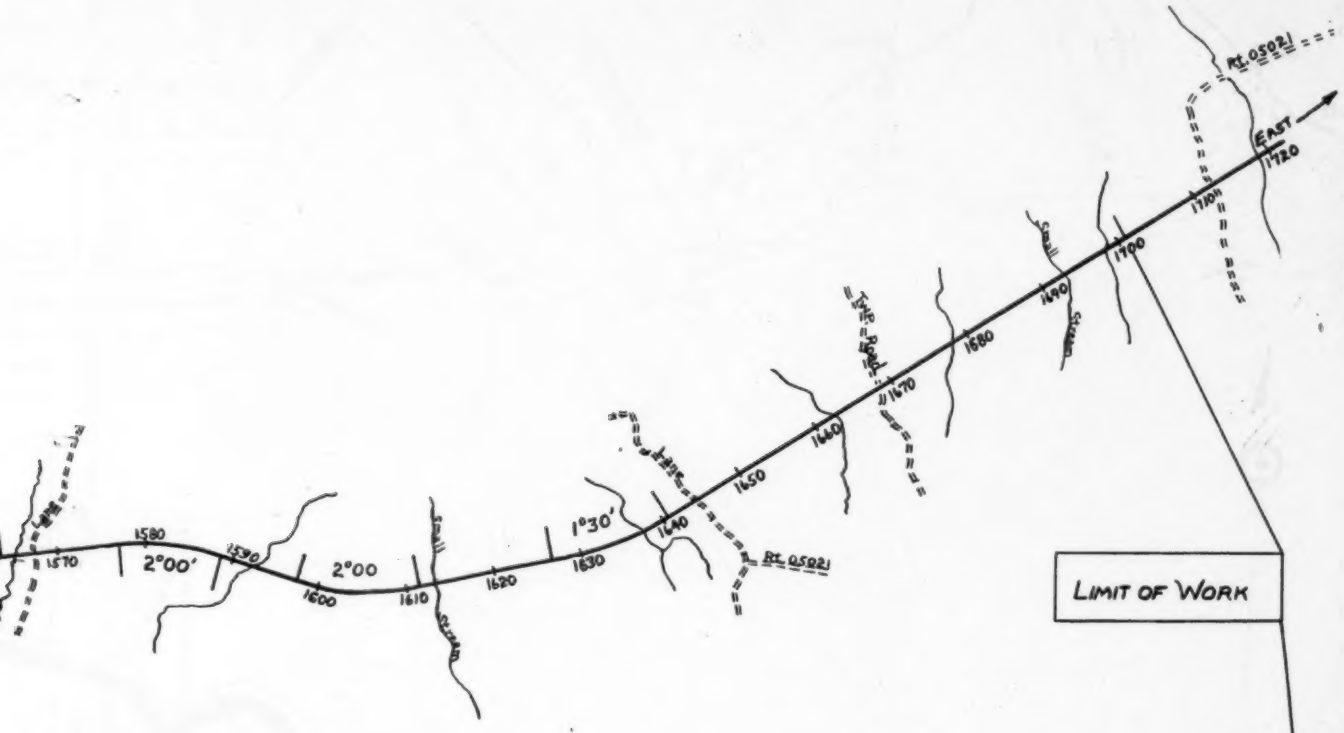
TYPICAL CUT AND

ON THE PENNSYLV

A cross section drawing of the cut and fill
Construction Company of Baltimore, Ma
and 14 in Bedford County. Total length
for the handling of 1,295,000 c

(Sketch courtesy Pennsylvania



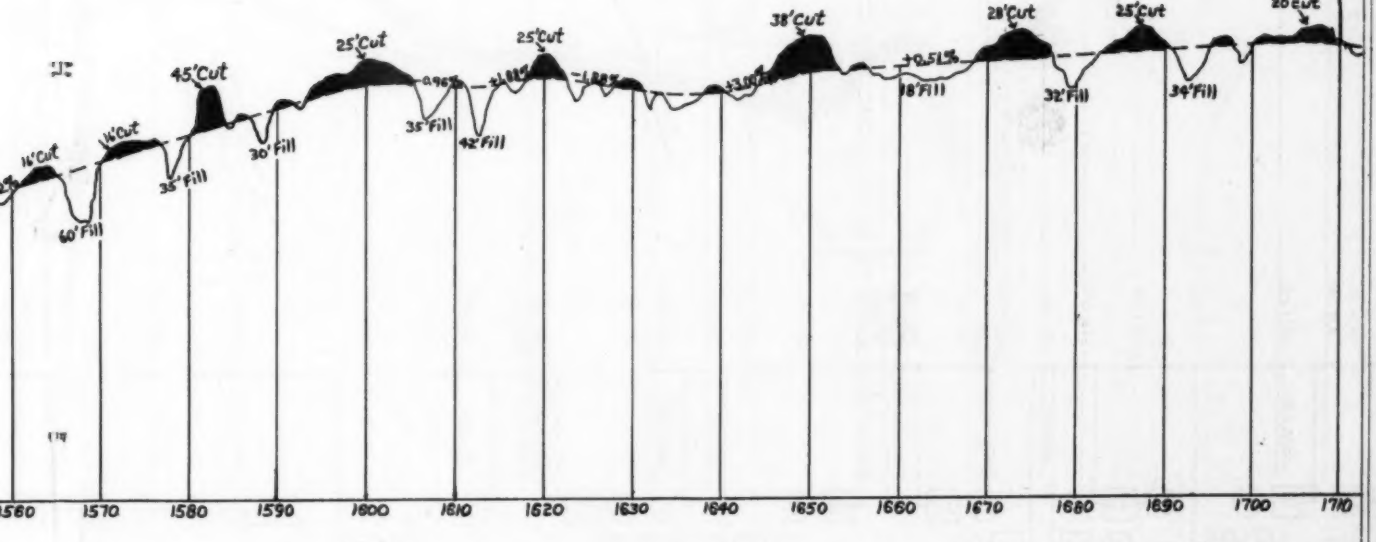


AND FILL SECTION

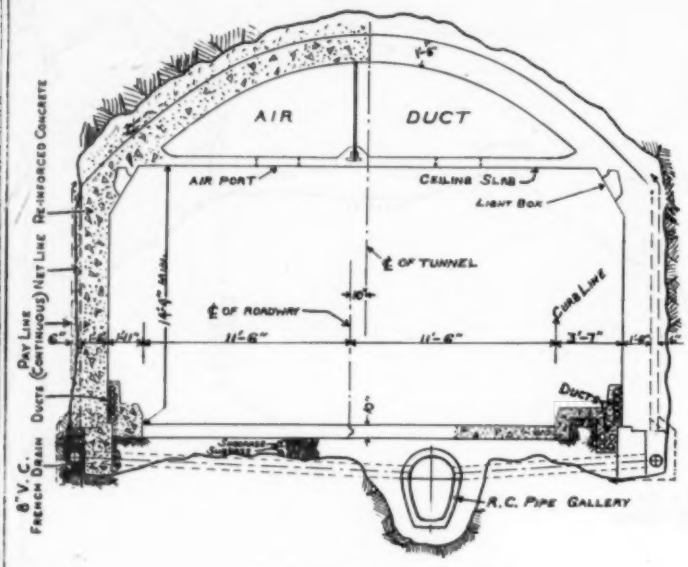
NSYLVANIA TURNPIKE

nd fill operations undertaken by the Empire re, Maryland on contract No. 9, Sections 13 length of the contract is 5.45 miles, calling 5,000 cubic yards of dirt and rock.

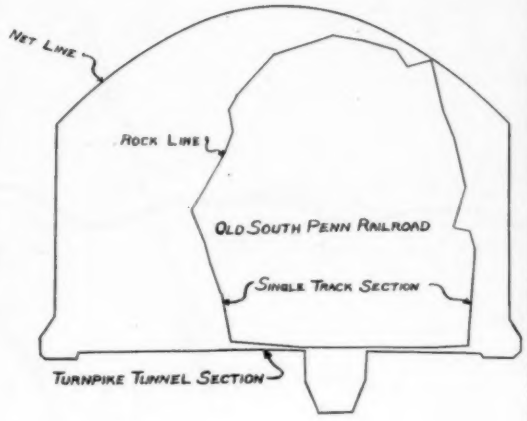
nnsylvania Turnpike Commission.)



MAP INSIDE — DO NOT TEAR

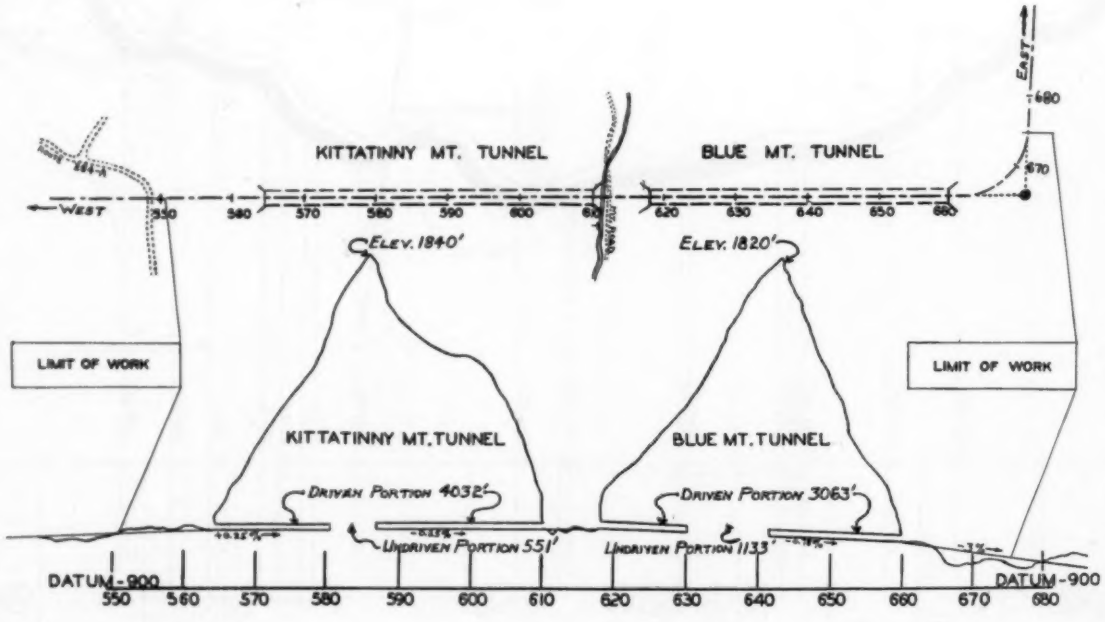


TYPICAL TUNNEL SECTION



• Top: (Left) A rough diagram of a typical tunnel section showing drainage and ventilation provisions. (Right) Comparison sketch of old Penn railroad bore and enlarged Turnpike bore. Bottom: Profile sketch of Kittatinny and Blue Mountain tunnels showing driven portion of the old Penn railroad bore.

(Sketches courtesy Pennsylvania Turnpike Commission.)



Making the Desert Bloom

Diverting 218,000 acre feet of water through 350 miles of ditches, the South San Joaquin Irrigation District changes a former desert area to fertile fields.

IT IS HARD to imagine that the wide, level fields of San Joaquin, bright with the green of growing things, were at one time barren desert wastes. Through the efforts of men and machinery this former desert land has been transformed into fertile, food producing fields.

In 1912 the state of California started the work of reclaiming this land and in 1915 the first water came into the South San Joaquin Irrigation District. Since that time the South San Joaquin Irrigation District has extended the system until it includes 350 miles of ditches irrigating over 52,200 of the 71,000 acres that make up the District. At present under the capable supervision of C. J. Campbell, Chief Engineer, S. L. Steele, Secretary, and O. H. Gotschall, Construction Superintendent, the District is constantly improving its irrigation system.

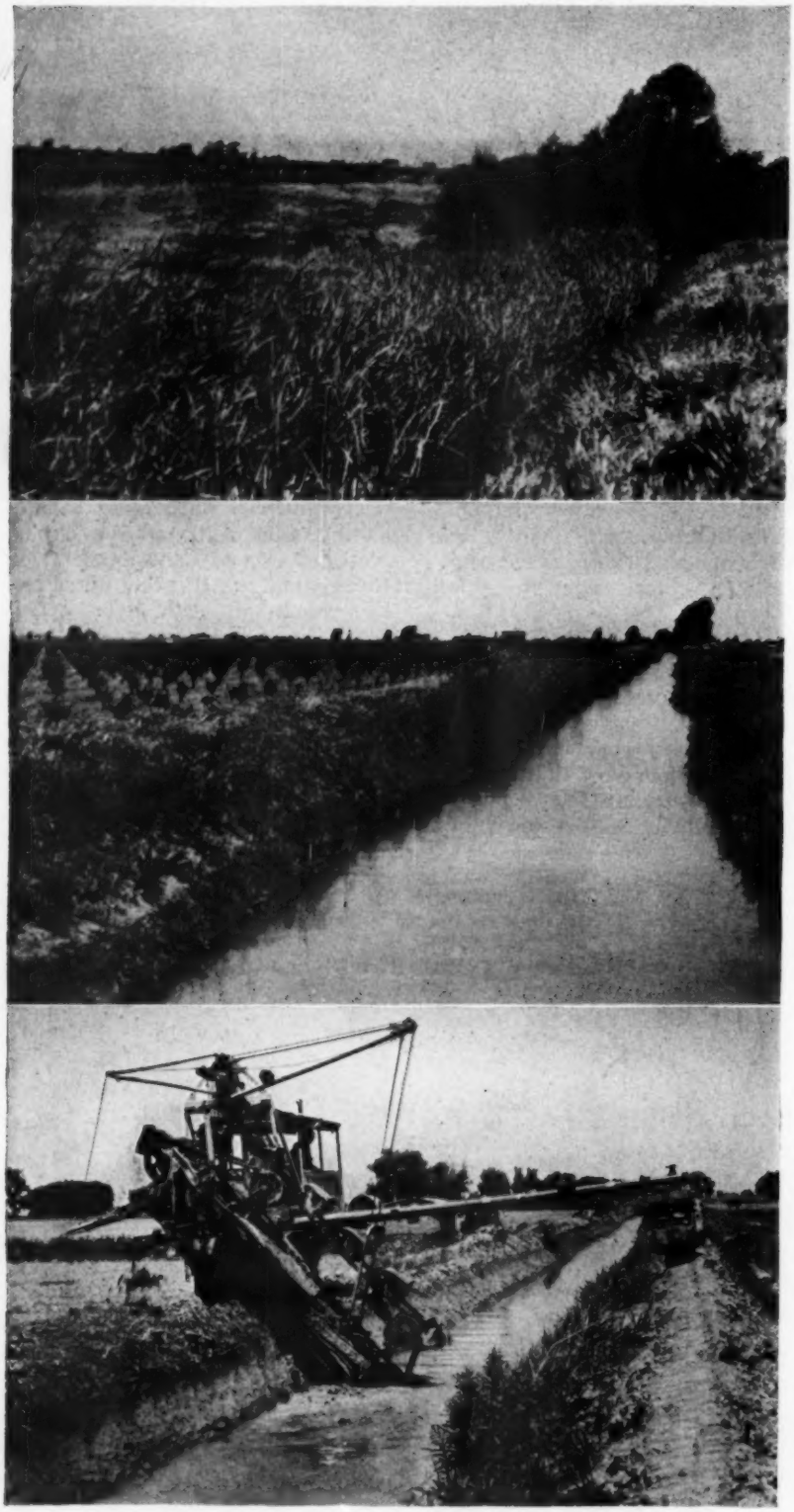
Irrigation Water Source

The source of irrigation water for the South San Joaquin District is the Stanislaus River which winds along near the District's southern boundary line. Diverted from its regular river course by the Goodwin Dam, near Knights Ferry, the water runs approximately four miles through a joint canal, shared by the Oakdale Irrigation District. This canal has four tunnels, the longest being 3,000 feet. From the division point, the water scheduled for the South San Joaquin Irrigation District continues through a canal, having a capacity of 900 cubic feet per second. There are five tunnels and the Hilt Sag flume on this canal.

Hilt Sag flume is a concrete structure approximately one-half mile long and one hundred twenty-five feet above the ground. The present structure was constructed at a cost of approximately a quarter million dollars, and replaced the old wooden flume.

● **A United States Department of Agriculture aerial view of a section of the South San Joaquin Irrigation District. In the foreground is the winding Stanislaus River and the jogged line directly above it is the main distribution canal. Note the branch canals running obliquely from the main canal.**

● Top: Choked by a heavy growth of tules this ditch permitted very little water flowage. Center: Another view of the same ditch after cleaning by the Bucyrus-Ruth excavator. Bottom: Cleaning out a ditch with the excavator. Note how the excavated material builds up the ditch sides to serve as a roadway for the caterpillar treads.



Two Reservoirs Used

Woodward Reservoir, holding 36,000 acre feet of water is a storage and regulation reservoir to store the waters released from Melones Reservoir and regulate the water into the lower main canal supplying the distributary canals.

Melones Reservoir is a storage reservoir having a capacity of 112,000 acre feet and is located on the Stanislaus river near the historic town of Sonora. This reservoir is owned jointly with the Oakdale Irrigation District.

From Woodward Reservoir the water is transported along the east and southern boundaries of the District from where it is fed into the distributing laterals with capacities ranging from thirty to one hundred twenty cubic feet per second. There are 350 miles of these canals, of which 110 miles are lined with concrete.

Due to seepage losses in the 240 miles of unlined canal the District maintains 80 miles of drainage canal.

Canal Maintenance

To keep the canals free from weed growth that would slow up the water flow and cause excessive evaporation and seepage, the district has employed a Bucyrus-Ruth excavator since 1936. The machine is also used to cut new irrigation or drainage ditches. Working during the winter months, from November to March, the excavator cleans and services about 100 miles of canal a season.

Flexible in its operation, the ditch excavator can be adjusted to work from various angles to facilitate the cleaning and building up of banks for any size or shaped ditch. Mounted on caterpillar treads, the machine requires very little passage way and its frame is easily adjusted so that it can straddle or work from one side of a ditch.

For the type of work being done in the South San Joaquin Irrigation District the ditch excavator straddles the ditch and lowers its endless chain of self-cleaning buckets, mounted on a digging ladder, to the proper angle of the ditch slope. The excavator follows the course of the ditch, clean-

ing out one side of the ditch at a time and throwing the excavated material in a continuous spoil pile running parallel to the ditch.

Cutting through heavy growths of bamboo and willows as thick as a man's arm was part of the heavy work of the ditch excavator, while the average job consisted of cutting off berms and cleaning out rank growths of Dallas grass, Bermuda grass, and other noxious weeds along the sides of the irrigation canals.

Working in dry material and digging drainage ditches for the South San Joaquin Irrigation District the excavator also loaded directly to trucks that hauled the excavated material to spoil piles.

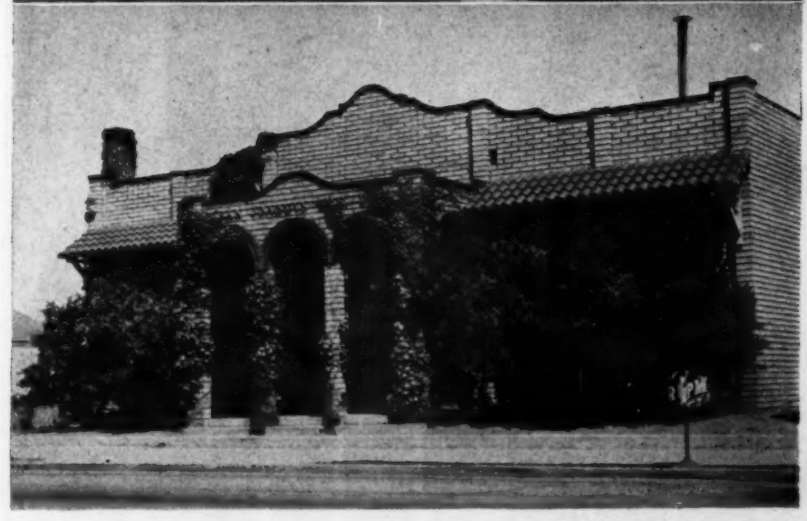
Through the use of modern methods and equipment the South San Joaquin Irrigation District has been able to supply water to the farmers at a cost of $5.40 an acre per year. Farmers are assessed for the water service according to the property value of the land using the service. The usual schedule of water usage is 30 minutes per acre every 30 days. Some farmers find it advantageous to use the water on 10, 21, or 25 day period schedules with reduced time limit.

Farms in this District average 34 acres each, and are nearly all prepared for irrigation in the strip check method. The average cost of grading the land being $30 per acre.

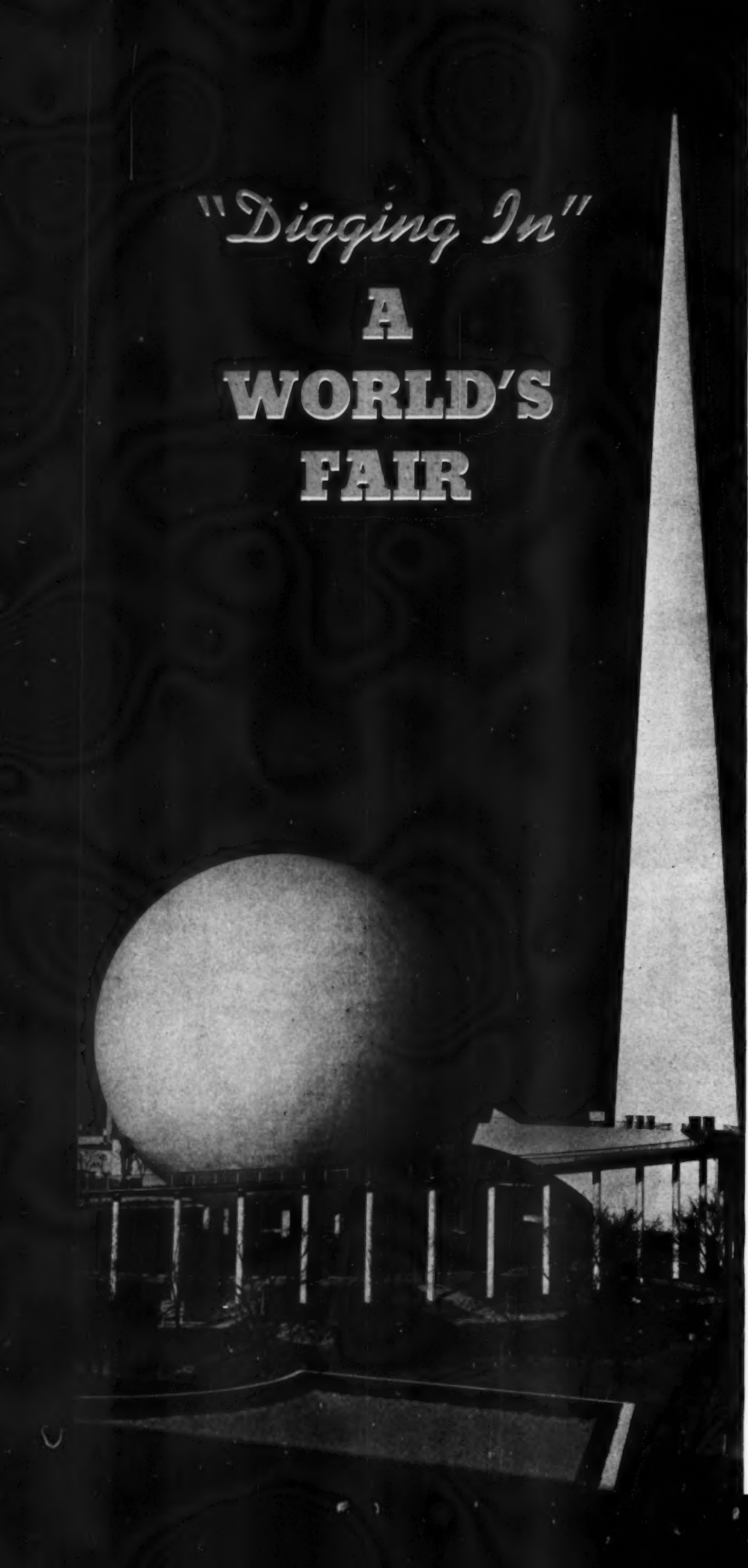
Crops Are Varied

The major crop is alfalfa, producing about six cuttings per year. Fruit, grapes and nuts are produced extensively. Sweet potatoes, berries, beans, corn, spinach, and other vegetables are also grown. Even frog raising is a product of this fertile land that was once a desert.

Manteca, California is the headquarters of the South San Joaquin Irrigation District. The water service is carried on by 22 ditch tenders, 24 night men and about six extra men under the direction of A. MacNeil, water superintendent. Only 18 men are used on maintenance during the summer months while in the winter season 60 to 70 men are used for work on canal lining, cleaning, and various other tasks.



● Top: Looking down a recently cleaned lateral ditch from a concrete siphon structure. Center: An orchard of young fruit trees made possible by irrigation operations. Bottom: Headquarters of the South San Joaquin Irrigation District located in Manteca, California. This building houses the administration offices of the district.



"Digging In" A WORLD'S FAIR

Creating a fitting setting for the dazzling "World of Tomorrow" out of a vast ash and refuse dump was a difficult task efficiently accomplished by the men and machinery of Arthur Johnson & Nescaro Company of New York.

By F. N. HOLLINGSWORTH

PRELIMINARY work in preparing the site of the World's Fair, New York for construction of the exposition and its numerous buildings was an enormous job of excavation and it was the largest and most rapidly done rehabilitation job ever accomplished in America. Within 190 working days some 6,700,000 cubic yards of ash fill and meadow mat were excavated, moved and levelled, without the loss of a man and hardly any casualties.

Many an engineering problem was solved, and numerous unique difficulties were overcome during the conversion of deserted swamp land to the "World of Tomorrow." The entire site covers 1,216½ acres, of which 132 acres are excavated lakes, and 200 more acres a huge paved parking field for automobiles. The site is 3½ miles long by 1¼ miles wide and the total investment, including money spent by the Fair Corporation, the New York City government, other state and foreign governments and private exhibitors, was $155,000,000.

Grading Record Established

Engineering experts say that the feat of the contractors, Arthur Johnson & Nescaro Company of New York in accomplishing their huge grading job, under the unique conditions involved and within 190 working days, sets a record that may stand for a long time. This excavation and grading job called for a payment in total of $2,200,000 by the city of New York, to which municipality the site reverts at the close of the Fair, to be turned into a municipal park and playground.

Originally the site was an enormous dump for ashes and refuse from the city of Brooklyn which had been accumulating for 26 years over a salt marsh or

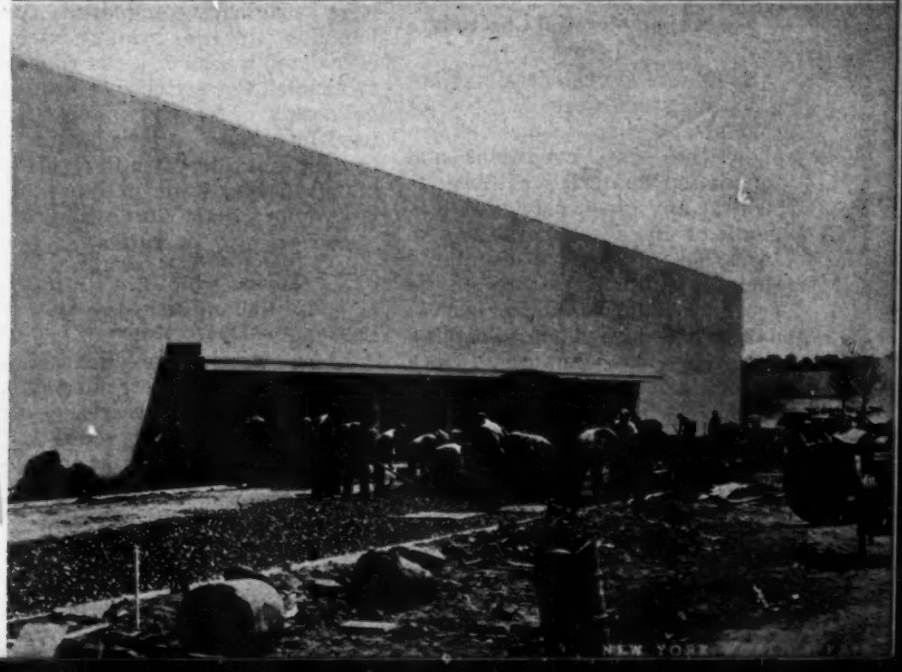
UMI

swamp that was for many years simply an extension of Flushing Bay, Long Island. Fifty million cubic yards of this ash and refuse had been dumped here in that quarter century, the city Department of Public Works having stopped use of the area for such purposes in 1934, when it began acquiring tracts of ground to be used for a parkway system and eventually a great park. The New York City Park Department had supervision of this big grading operation and had the dual interest of seeing that the New York World's Fair was provided with an adequate site, easy of access from the city proper, and an eventual park site. This, also, is said to set a record in municipal economies.

Engineering Aided By Science of Soil Mechanics

The job of reducing the seemingly impregnable ash dumps and marsh lands of the Flushing Meadows into firm, secure, rolling terrain represents the most recent utilization of modern engineering methods and the first full use of the new science of soil mechanics. There were fifty million cubic yards of ash debris, interspersed with every conceivable sort of refuse, including old bedsteads, automobile bodies, tin cans and many other varieties of junk. In some places the piles of ashes and refuse were 90 feet above the original swamp level, and the wonder is how the ash disposal company was able to pile it so high.

It was found that piece-meal filling in the area was impracticable. Test borings over the tract of dump and swamp land indicated that anything less than one major operation, which would blanket the entire area with a carefully balanced weight of the dry ash fill would not provide the permanent ground desired, because evenly distributed weight would cause the least possible disturbance of the crust of meadow mat



● Top: Tearing down and grading a high part of the wood grown ash dump. Center: Section of the levelled ash dump, showing floodlight tower for night operations and, in the distance, a dragline. Bottom: Laying the mix for a bituminous macadam World's Fair street.

● Putting on the final layer in street paving operations around the World's Fair Administration Buildings.

and the underlying strata of wet silt. In other words, even distribution and layering of fill would increase the surface tension over the swamp and make for true consolidation. Fill and grading by parcel or in spots here and there might break down the crust and then the fill would be likely to create mud waves.

Fifty years from now, according to calculations, the fill will have compacted to the grades desired by engineers of the New York City Park Department, with most of the consolidation taking place within the next two years.

Foundation Material Carefully Studied

So minute are the details of engineering studies used in the work that at any time calculations can show the exact conditions and foundation material within one foot, at any given point and to a depth of 100 feet below the surface. The contractors also made their own intensive study of the problems involved, and presented a comprehensive plan for handling the work, with the use of both dry-fill and semi-floating equipment.

All this equipment was purchased new for the job and was driven to capacity 24 hours a day, five days a week, a full mechanical force utilizing the weekends to check up and overhaul the machines. The bulldozers virtually served their alloted span of life right on this one job.

Six new 2¾-yard gas driven shovels handled the lighter material in the ash dumps. Eight cranes figured in miscellaneous excavation and in handling the great timber mats and roadways necessary to the floating equipment by which two large lagoons were excavated. Four gas-driven draglines, with 70-ft. booms, scooped out the meadow mat to a total of 800,000 cubic yards. Twenty tractor-trailer bottom-dump trucks of eleven cubic yards capacity each were originally employed for handling dry material. Sixteen rear-dump trucks of lesser capacity handled wet material. Fourteen bulldozers of varying sizes were used on dumps for levelling and to maintain roadways. In addition outside trucks were hired until at times more than 120 outside carriers were in operation at one time.

Continuous Dirt-Moving Operations

There were three shifts, 7½ hours each, for the working day. Illumination was necessary, of course, for the night work that went on just the same as in daylight, and for this the greatest lighting system ever set up for such a purpose was installed, consisting of 12 tubular frame towers, each about 80 feet high, from which floodlights could be focused practically anywhere needed. Electric current for this work alone cost $80,000 during the period of the contract. Over a million gallons of gasoline were consumed by the motors of the equipment, together with over 250 barrels of lubricating oil.

To keep the equipment at top-notch efficiency, the contracting firm established repair yards, field offices, a completely equipped machine shop, store room, tire storage house, medical office with attendants, and ample dressing and lavatory accommodations for the 500 men employed on the three shifts. On the biggest day 55,000 cubic yards of fill were moved and the equivalent of about a million truck loads of fill and meadow mat.

Preparation of the site opened up a gold mine for junk collectors, with thousands of tons of old metal recovered, to be sold at a good price. Junkmen haunted the works day and night and as many as 30 to 40 junk trucks were busy continually. All this material was free to the junk collectors.

Meadow Mat To Be Used For Top Soil

The contractors left about 800,000 cubic yards of the fibrous salty, and highly acid meadow mat distributed evenly over areas not immediately needed by the Fair for its buildings. Part of this was obtained when a channel was dredged in Flushing creek and more from the dredging of two large lakes. This mat is extraordinarily rich in organic matter, that can be used for top soil in which to plant grass, shrubbery and trees, the process having been worked out by the Park engineers. Two years of study and experiment have shown the Park Department how the material can be re-worked into topsoil with as much as 40 per cent organic content—compared with six per cent requirements of New York state parks.

This mat is ploughed, harrowed, turned again and again, to be

windrowed with lime for five or six weeks; composted with raw horse manure for another period and then innoculated with phosphates and nitrogen. Use of this spot manufactured topsoil will save the city about $500,000.

Volume of Excavated Material Decreased

A curious feature of the grading operations was the change in volume of the material. Ordinarily, when earth is excavated and placed in a fill its volume will be greater in the fill than in the original borrow pit. But the ashes and refuse in the original dump contained so much decomposed organic matter that it was very porous and weighed only 65 to 80 pounds per cubic foot when undisturbed. When moved to a new location its volume and density each decreased about 35 per cent.

The original swamp filled a buried valley underlain with a stratum of sand, which was as much as 70 feet below high tide in many places. The overlying silt is very soft and contains a high percentage of water. At the swamp margins the sand comes up near the surface and the stratum furnished an excellent foundation for any loads carried down to it.

Use of Piles for Foundations

Where the ash fill was quite deep, temporary structures were built in spread footings. Where the fill was light, untreated timber foundations were used to support building columns. In some locations the floors were also carried on the pile foundations and practically all permanent buildings and bridges on the site have such foundations. Creosoted timber piles were used for permanent World's Fair structures and concrete piles for the New York City Building and the New York State Amphitheatre.

Where the ash fill was moderately deep a steel spud was used to punch the hole for the pile and then removed. The pile was lowered into the hole and a steam hammer used to give a couple of light taps, the pile and hammer dropping as much as thirty feet while the tip of the pile was passing through the soft silt. Then came appreciable resistance, with this increasing as the pile tip penetrated the underlying sand until the desired firmness and bearing capacity was reached. If, however, work of pile driving was stopped a few hours before the desired resistance was reached, the pile became frozen into the silt and ash fill and was difficult to start again. It is estimated that the Fair Corporation drove a total of 125 miles of piles, with many thousands more by exhibitors and concessionaires, who used their own contractors.

Although conditions were very favorable for spread footings, it was decided to construct the Trylon and Perisphere on pile foundations of creosoted timber. The Perisphere foundation consists of a cylindrical concrete wall on a circular concrete base, this in turn resting on 528 piles. Each of the three columns of the Trylon rests on a heavy concrete slab, each carried on 513 piles. Total length of piles in foundations of these two buildings is 17½ miles. Cellular sheet steel piling was used for a length of seventy feet for the boat basin.

Constructing the Roadways

Roads throughout the great Fair project have been designed for settling. All were put through

(Continued on page 602)

● Transformed into a scene of futuristic splendor, this part of the former ash dump is now the site of the Main Exhibit Area which is dominated by the Perisphere and Trylon, theme structures of the exposition. (McLaughlin Air Service Photo.)

EXCAVATING ENGINEER

A Monthly Publication
Devoted to the Excavating Industry

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Digging In For War

The excavating industry already feels, and will feel still more keenly, the influences of the European holocaust of war. Just how greatly it will affect our industry and your individual business is, of course, impossible for any man to foresee, but there are certain fundamental influences at work which we can perhaps summarize for you as a possible help in setting your sails for the new course which we must all undertake.

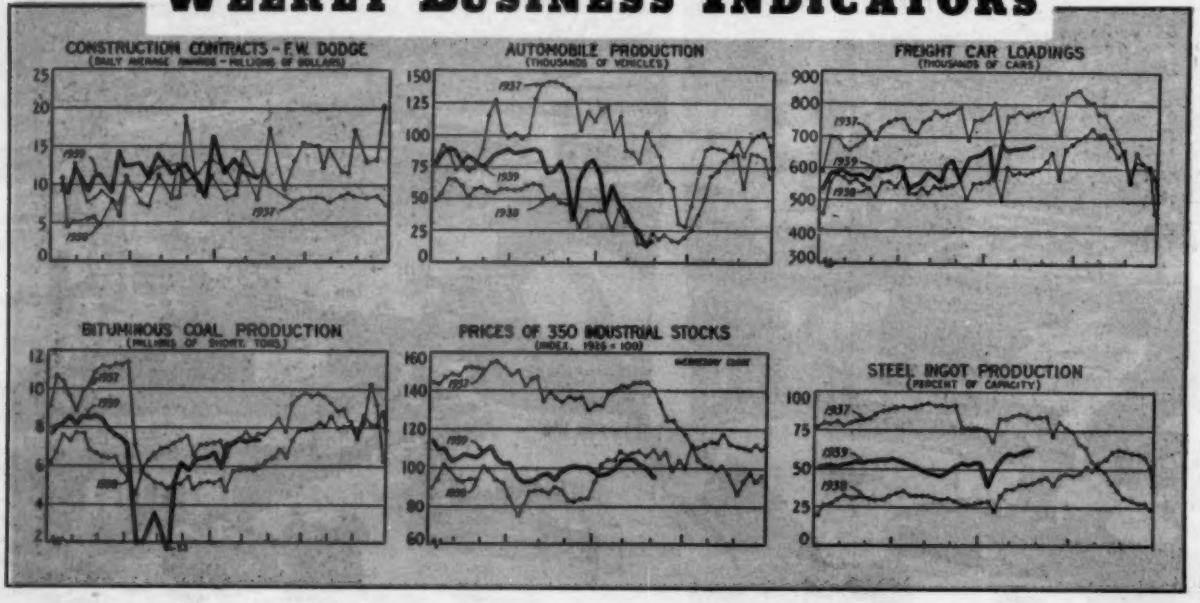
As this is written it seems probable that a long war in Europe of at least two or three years duration is almost certain. However, it must be remembered that on one side of this conflict is a very much "one-man organization" and that his span of active life, subject to all the risk of mortality plus the risks of war, is probably a decisive factor in predicting what the future will bring. At his death, no doubt, his successors would attempt to carry on, but how successfully they could do so, is a very difficult question to answer.

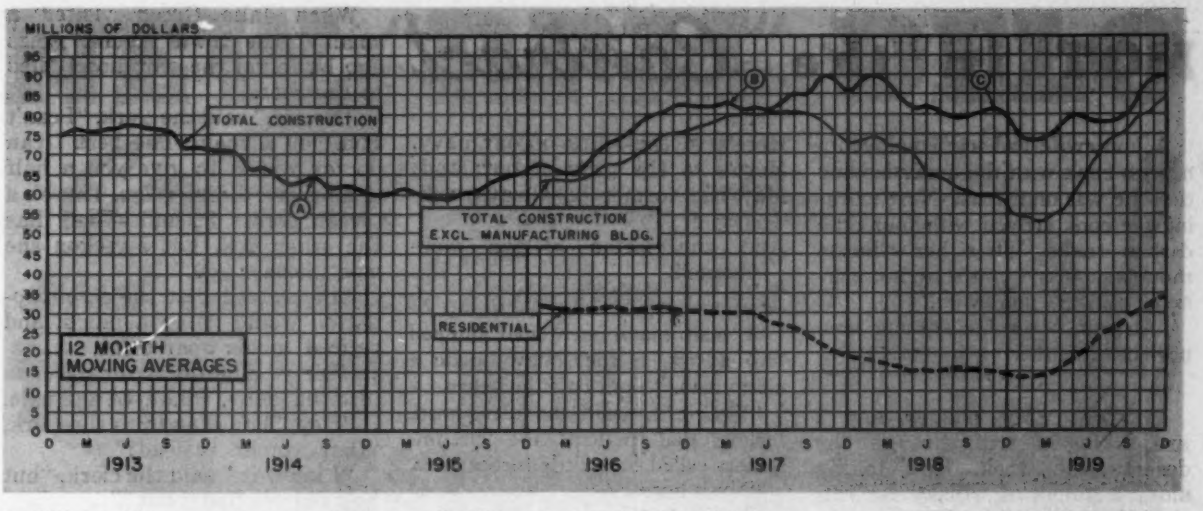
But, if the war is to continue for three years or more, it is safe to predict that industry in the Americas will be called on to the limit of its production capacity to supply the export markets of the world. Already European industrial competition in world markets has been practically eliminated as men and machines in the great industrial countries on the eastern side of the Atlantic turn to the grim business of war. Not only will the world need the United States as a primary supplier of manufactured products, but both North and South America will also be called on for an ever growing increase in exports of raw materials and agricultural products. So, whether the U. S. Congress, called in special session, continues our present neutrality law which prevents the shipments of armaments and amunitions, adopts the cash-and-carry plan which would further stimulate American business by permitting the shipment of materials for the battle fields, or repeals the law entirely, our whole business structure is likely to be plunged into a boom cycle with a resulting demand for quickly increased production capacity.

As a result, in the construction field, while there probably will be a reduction in the amount of new public work carried on, this is likely to be more than offset by the increase in private construction and the increase in our domestic rearmament activities. Road building financed by its own sources of taxation will undoubtedly be continued at the present level and as our system of roads is vital to our national defense picture this is as it should be. Further, the return of prosperous times and increased use of highways for transportation of the supplies for our export and domestic markets will undoubtedly increase the tax revenue on which the size of our road building program is based. Mining quickly felt the impetus of the war. Copper, iron, zinc, tin, nickel, nitrate, phosphates, aluminum, fluxing stone and other products of the mine are all "war babies" whose production facilities will be taxed to capacity by the demands of the war-torn world. The industrial expansion will furnish an increased demand for power, stimulating the excavation of coal and will tend to hurry up the completion of our water-power projects. The oil industry and the logging industry, in both of which excavating plays its part, are already feeling the effect of war and the resulting rearrangement of world markets.

Transportation again faces the need for increased facilities rather than a headache of declining revenues, and the excavating field can again look to the railroads as well as to highway construction for a part of the contractor's earnings. Increased prosperity will probably further accelerate the recent expansion in home

Weekly Business Indicators





● Prepared by F. W. Dodge Corporation this chart shows the construction trends for the area east of the Mississippi River and north of the Mason-Dixon line from 1913 to 1919. "A" designates start of the World War, "B" entry of U.S.A. in the war, and "C" termination of war.

building with more basements to dig, more brick and clay, aggregates and cement, more logs and lumber, more steel and stone, to produce.

Many problems confront the excavating industry in this picture for increased digging. We must plan for greater efficiency of men and tools; we face the need for more trained men with only raw recruits to work with; we will be confronted by an increase of labor troubles; we may fight some day ourselves in the incendiary conflict across the seas; and beyond all these we face with reasonable certainty the fact that when it is all over we must "dig in" to endure another great post-war depression.

War, after all, is just what Sherman said it was—"War is Hell!" — even for the innocent bystanders.

How First World War Effected Construction Activity

As indicated in the accompanying chart, prepared by F. W. Dodge Corporation, the general trend of total construction activity had been downward for twelve months prior to the 1914 war declaration. It continued downward for another twelve months, following which it turned upward with the general business stimulus of enormous war orders from the belligerent nations.

Following our own entry in the War in 1917, construction went to new peaks late that year and in early 1918. War orders and priority orders of the War Industries Board gave a big stimulus to manufacturing buildings, and also to army cantonments, naval bases and other war activities. During the same period, however, private construction (exemplified in the chart by the residential building curve) declined very considerably; less because of a slackened demand than for the reason that materials and man-power were commandeered for war construction and also, in less degree, by reason of mounting construction costs.

The Armistice, in November 1918, was followed by a short period of declining construction activity, and then by the speculative building boom of 1919-1920, which was the first general movement toward making up accumulated shortages of private construction.

Accompanying these construction trends, there was a general rise of very marked proportions in price levels of all commodities, including construction materials, and in wages of building labor, resulting in a new price plateau, below which commodity prices and construction costs have not fallen since that time.

Differences in the present situation, as compared with 1914, are as follows:

1. Psychological preparedness —Today the expectation of war has been present for many months; actual outbreak does not involve surprise and shock to the extent it did in 1914; it even appears to relieve tension and hesitation, at least temporarily.

2. Preparations for orderly marketing of foreign-owned securities are now being made by our security exchanges, banks, and governmental agencies. Closing of the New York Stock Exchange for a period of five months, as in 1914, seems quite improbable today.

3. The long-term trend of construction is upward at this moment, not downward as in 1914.

4. Such stimulus to American industry, trade, and employment as may arise from war orders from abroad will, even during such period as the United States remains neutral, be partially controlled by neutrality legislation.

5. The needs for expansion of American manufacturing plant facilities to take care of war orders are probably considerable, but proportionately less than in 1914.

NOT in the *Contract*

A housewife had just employed a negress cook with the understanding that she was unmarried. Next morning the cook arrived with four little darkies trailing after her. "But I thought you said you were not married," said the housewife.

"Ah aint, Mam, but Ah aint been neglected, neither."

Cowboy: "My podner and I are taking a trip through the desert next week. He's taking along a gallon of whisky for rattlesnake bites."

Visitor: "And what are you taking along?"

Cowboy: "Two rattlesnakes."

John, who was visiting in a distant city, received a telegram from his wife reading, "John, remember you are a married man."

His answer read: "Telegram received too late."

Contractor: How much will this bridge for my teeth cost?

Dentist: Oh, about $175.

Contractor: Couldn't you just put in a culvert?

Here's to the ships of our navy,
Here's to the girls of our land;
May the former be always well-rigged
And the latter always well-manned.

A man much inebriated flopped into a seat in the lobby beside a clergyman. "Nysh day" he began.

"Yes, it is," said the clergyman, feeling that perhaps the circumstances called for a little forbearance.

"Nysh hotel."

"Yes, I find it very comfortable."

"Have a drink with me?"

This was too much. The clergyman's face set severely and he intoned sternly, "No, thank you, sir. I don't indulge."

"Shay, whattaya givin' us, feller? You're drunk now. You gatsha collar on backwards."

Blonde—Poor Ellen was arrested because her balloon dance was too daring.

Brunette—You mean she went beyond herself?

Blonde—No, just beyond her balloon.

"Say-y! Where did you say you got your blasting experience?"

When Jake Green visited a small Texas town several years ago he found the only hotel filled to the roof.

"No, sir," said the clerk, "I can't give you a room. The best I can do for you is to give you a half of a private dining room. There's a screen across it, and a lady has the other half, but I reckon she won't bother you."

Jake agreed that the accommodation would do in a pinch, and retired to his apartment.

Thirty minutes later he ran into the lobby, wild-eyed and pale.

"Hey," he bellowed to the clerk, "that woman is dead!"

"I know it," said the clerk, "but how did you find it out?"

Two Irishmen were shown around a colliery for the first time. When they saw the coal coming up from the shaft from the pit, Mike remarked to his companion:

"Sure, and I like to see the men who put those great lumps of coal in the skips. They must be terrible strong."

"Don't be absurd," said Pat, "it's so dark down there they can't see what they are lifting."

"How'd you get along with your wife in that fight the other night?"

"Aw, she came crawling to me on her knees."

"Yeah? What did she say?"

"Come out from under that bed, you coward!"

"I shall die," throbbed the suitor, "unless you consent to marry me."

"I'm sorry," said the maiden kindly but firmly, "but I will not marry you."

So the fellow went out West and, after 62 years, three months and a day, became suddenly ill and died.

Following an address to a group of American students, a Chinese professor announced that questions were in order.

"How," asked a precocious young woman, "do the Chinese disseminate sex information in their country?"

"Like other peoples," replied the professor, "they just grope around in the dark."

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For the first 50 hours New "RPM" DELO was used to "run-in" the Fulton Diesel's brand-new pistons, rings and liners to a still smoother "mirror finish". Result—longer, full-power engine life from the start. Then the real performance test! Of course no rings were stuck—bearings were free from any sign of corrosion or wear—filters came through clean and unclogged.

BUT MORE! *Fuel consumption and exhaust temperatures were lower than ever recorded on any engine test in the Fulton shops!* Reduced operating costs! Higher engine efficiency!

Naturally, after its great performance test, New "RPM" DELO is recommended for Fulton Diesel Engines. Try it in your own equipment, regardless of size, type or make. You'll profit by it!

New "RPM" Diesel Engine Lubricating Oil now available everywhere in the gray barrel with the blue head

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FOR EVERY DIESEL

STANDARD OIL COMPANY OF CALIFORNIA

For your convenience in writing to Standard Oil Company of California, you will find a card bound in this issue.

Equipment you ought to KNOW ABOUT

New Convertible Shovel

A new 2½ yard excavator that offers the rugged strength of the larger heavy-duty quarry and mining machines combined with the speedlined design and mobility found as a rule only in machines of smaller capacities, the 54-B is now being offered by Bucyrus-Erie Company, South Milwaukee, Wisconsin. It is a diesel-powered convertible shovel, dragline, clamshell, lifting crane.

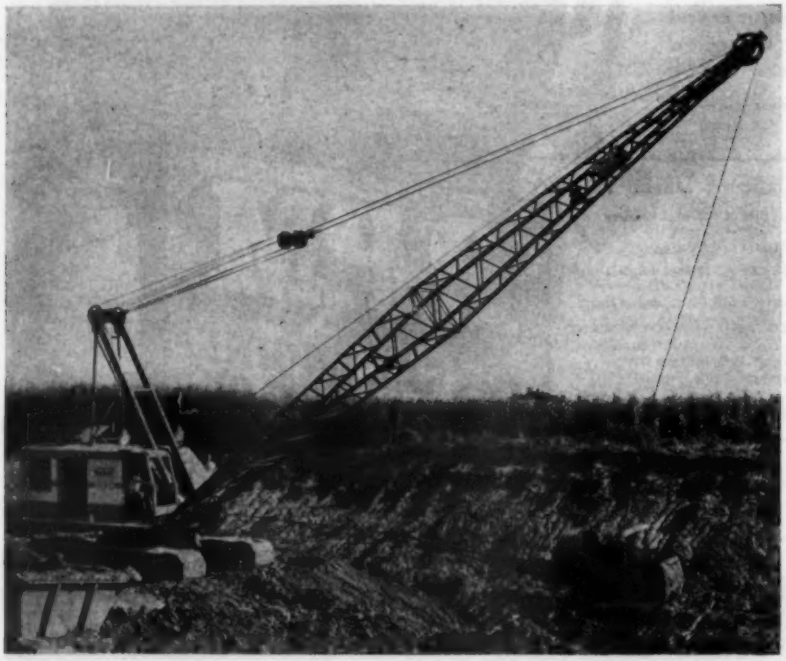
With husky quarry-type boom, wide outside dipper sticks, modern welded heavy-duty dipper, and positive independent chain crowd, the 54-B shovel front-end is the same type used so successfully on the 4, 5, and 6 yard Bucyrus-Erie quarry and mining shovels. Yet the machine is so compact that it comes within clearances of most U. S. standard gauge railroads and can be shipped without major dismantling. Clearances are reduced, and the center of gravity lowered, by combining roller path and swing rack in the truck frame casting; center pintle and the heavy reinforcements necessary to support it are eliminated by the use of single plane conical hook rollers; A-frame is arranged so that it can be easily lowered without dismantling the cab; and all excess weight is eliminated by the use of special modern, high-strength, light-weight alloy steels. Consequently, the 54-B offers a compactness and mobility which, the manufacturer claims, has never before been found in a machine of such large capacity.

Revolutionary in their simplicity, the new 54-B clutches set new standards in smooth, cool operation. Few parts, interchangeability of bands, and easy accessibility mean few adjustments, easy maintenance. Easy to operate, these clutches give the operator the "feel" so necessary to fast operation.

Accessibility for maintenance and adjustment has been a major concern of the 54-B's designers. The entire right side of the cab is free of machinery, and a roomy cross-aisle between engine and main machinery provides ample space for making adjustments easily and quickly. In addition, the 54-B boasts many features contributing to ease of on-the-job maintenance. For example, the drive shaft is in two sections; hence either section of the shaft can be removed without disturbing the other. This convenient accessibility plus the machine's rugged strength keeps "time-out" at a minimum, so that more time can be spent in actual digging.

Ratchet type chocking brakes provide quick free move-up for either dragline or shovel, with automatic locking against the push-back of the digging action. For dragline work on soft ground, extra-large tapered "swamp cats" are available. An independent power boom hoist makes the 54-B an efficient machine for crane and clamshell service. If desired, an electric drive can be substituted for the diesel power unit.

Not a mere refinement of older model excavators, the 54-B is a new machine from the ground up. Since space permits mention of only a few of its revolutionary features of design and construction, get a complete description of this amazing new 2½ yd. excavator. Write to this magazine or to Bucyrus-Erie Company, So. Milwaukee, Wisconsin, and ask for Bucyrus-Erie Bulletin No. 54-B1.



Double-Boom Rock Loader

The new Sullivan double-boom Rock Loader, announced by the Sullivan Machinery Company, Michigan City, Indiana, eliminates the need for anchoring tail sheaves at the face or heading and effects considerable saving in time and labor.

This new Rock Loader provides

ALL GRADES LOOK ON THE LEVEL TO A "CATERPILLAR" DIESEL TRACTOR!

THEY'VE got real hills around Pittsburgh! . . . but the Harrison Construction Company, in preparing ground for a housing project, put a real "hill outfit" to work: a "Caterpillar" Diesel Tractor teamed with an Athey wagon!

In addition to all the advantages of the Athey's tracks, look at those of the "Caterpillar" Diesel's. The deep grousers are built to cling to steep slopes . . . conquer rough conditions underfoot . . . and take a high percentage of the engine's power and turn it into *pull!*

And those aren't the only reasons this outfit got the job. Notice how well the wagon is spotted under the shovel — in spite of cramped quarters. With a "Caterpillar" Diesel's maneuverability, you can get in and out of tight places *in the kind of time that means money!*

Then there's durability — tractor and wagon equally strong, and that strength emphasized by the wagon's ability to stand the shock of loading, *even on a treacherous angle!*

All grades look on the level to a "Caterpillar" Diesel Tractor. But apart from power and traction to handle hills, you've got time-saving maneuverability . . . money-and-maintenance-saving ruggedness . . . and outstanding *fuel-economy* to drive down your costs, *and drive up your profits!*

See your nearest "Caterpillar" dealer, or write direct for more information.

CATERPILLAR TRACTOR CO., PEORIA, ILL.

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DIESEL ENGINES • TRACK-TYPE TRACTORS • ROAD MACHINERY

UMI

an extremely flexible method for digging, conveying and loading. In the Green Mountain conversion tunnel an eight foot round of 200 yards is mucked and loaded in three hours, it is claimed. The scraper reaches over the muck pile, removing first the rock close to the heading, so that drillers can drill the next round while the remaining rock is being removed. The loader operates on permanent track at from twenty-five to fifty feet from the heading.

New Bank Sloper

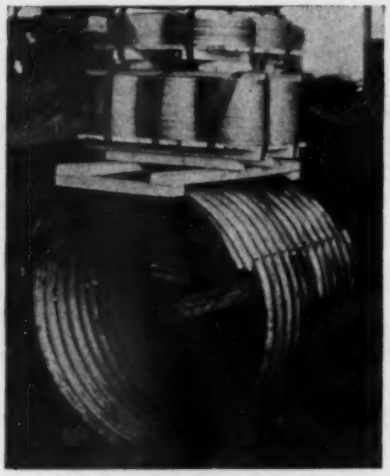
A new bank sloper, manufactured by Cornett Sloper, 607 Degraw Street, Brooklyn, New York, has recently been introduced. The manufacturer claims the machine can slope from the vertical to an approximately horizontal and can be attached to any shovel in an hour's time.

With shovel boom elevated to approximately vertical and a twenty foot sloper boom, it would reach to a height of 38 feet. The sloper boom can also be made in longer lengths.

"Armco Light-Duty"

A new liner plate has been developed by engineers of The American Rolling Mill Company, Middletown, Ohio. Companion to the company's standard tunnel liner, the new corrugated plate will be known as "Armco Light-Duty." It is designed especially for small-diameter tunneling jobs. The new plates are available in standard inside diameters of 33 to 60 inches, 10 to 14 gauge inclusive.

Manufacturers say the plates are easily installed by unskilled men using only simple tools. Because of the shallow corrugated design of the Light-Duty plate



less excavation is required. The illustration shows a 30" length of 42" diameter, 14-gauge tunnel liner supporting 4010 pounds concentrated load. With side support, such as found under tunneling conditions, this load could be increased several times, it is claimed.

Corrosion Resistant Coatings

D. W. Haering and Company, Chicago, Illinois, has developed a new line of corrosion resistant coatings for external application to metal surfaces for protection from corrosion. These products are prepared in several forms to meet varying temperature requirements and may be applied by brushing, spreading or spraying on exposed surfaces. The films formed are resistant to moisture and contain sufficient film inhibitor to protect underlying surfaces from corrosion for an indeterminate period of time, it is claimed.

Motorpump

The Ingersoll-Rand Company announces the manufacture of the Motorpump. Designed for all types of general service, the pump can be used in quarries, mines and power houses to supply water or to drain projects such as dam or bridge work. The pump is built in

sizes for delivery of from 5 to 1,000 gallons per minute and heads up to 500 feet. Copies of a new illustrated folder, form 1917 are available.

Low Cost Motor Base

A new, low cost Motor Base called the "Automatic," which automatically maintains correct belt tension through the action of special high grade steel springs, is announced. This unique design makes it especially suited to short center drives.

One Ideal "Automatic" Motor Base covers all types of drives, horizontal, vertical, or overhead. Operates satisfactorily with any type of load, pulsating, steady or reversing, according to the manufacturer. The Ideal "Automatic" Tension Motor Base is marketed by the Ideal Commutator Dresser Company, 4104 Park Avenue, Sycamore, Illinois.

Single Drum Rear Mounted Cable Control

Convenience and accuracy of operation are outstanding features of this new "Caterpillar" cable control, claims the manufacturer. The control lever, located

at the forward right hand side of the operator, permits full attention to the work from a most natural and comfortable position. The lever position is adjustable to suit operators.

STEP ON IT, MARY.... I've got to be there early to get a CLEVELAND!

• Time and again word has come to us that the men are going to work early to be sure of getting a Cleveland, rather than some other drill that might be available. It is a well-known fact that Cleveland Drills turn out a lot of footage in a day—that they are easy to hold—handy to control—that they give less trouble, use less air—that they are generally more satisfactory alike to operator and owner.

It's no wonder, then, that Mike wants to be early to work, and that Mary has to "step on it," thus doing her part in making sure Mike gets the drill he knows he can turn out the footage with. Your men, too, will like Clevelands. And you will want no other make when once you have had these fast, efficient, machines on your job. Demonstrated any time, anywhere. Let us send the new bulletin 122.

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LEADERS IN DRILLING EQUIPMENT

For your convenience in writing to The Cleveland Rock Drill Company, you will find a card bound in this issue.

Pennsylvania's "Dream Road"

(*Continued from page 559*)

completed despite 13 idle days due to heavy rains. This section calls for the handling of about 600,000 yards of heavy shale in two cuts, one 70 the other 80 feet in depth. Working three 7-hour shifts a day, seven days a week, Frank Mashuda was making steady progress through one of the tougher sections on the Turnpike.

Four Bucyrus-Erie shovels, models 10-B, 37-B, 43-B and 48-B, head the Mashuda equipment line up. The 37-B, 43-B, and 48-B were worked in the heavy shale of the cuts while the 10-B dug across ditches along the finished grade that later were to be lined with perforated drainage pipe to take care of mountain spring drainage.

Ten Sterling 6-yard trucks and three 16-yard Athey wagons were busy hauling from the shovels to the various fills which were receiving the attentions of six Caterpillar mounted LeTourneau bulldozers, an Allis-Chalmers Model "L" grader and five 10-ton Buffalo-Springfield rollers. Five Caterpillar drawn 12-yard LeTourneau scrapers were also moving their share of dirt on the contract.

Contract specifications call for a maximum size of 16 inches for all stones in earth fill and no stones over 18 inches are to be present in rock fills. To fulfill this requirement a Koehring crane swinging a 1,000 pound "skull cracker" was used to break up the oversize on the rock fills. Slopes bordering the Turnpike right-of-way were limited by the commission from ¾ on 1 in rock to 1½ on 1 in ordinary earth. Hand finishing crews, equipped with pick-axe and sledge hammers were used to rid the slope of rock outcroppings and assure an even slope.

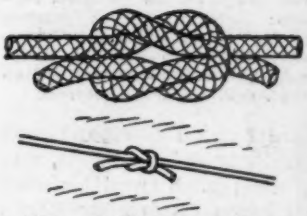
To aid in night operations skid-mounted Kohler light plants and floodlights were put into use by Frank Mashuda. Another important unit on the contract was an old General Motors panel truck that had been converted into a traveling service station. The Alemite greasing service given to all machinery by the truck was paramount in keeping all the equipment in fighting trim for the heavy continuous digging they were doing. A separate tank truck dispensed gas and oil on the job.

Structures on the Frank Mashuda contract were all sublet, one arch and one overhead to C. B. Taylor, an arch apiece to L. J. Luteri and subcontractor McLaughlin, and an arch and an overhead to A. R. Coffeen. Subcontractor McLaughlin had an old Bucyrus-Erie type A steamer rigged as a clamshell while subcontractor Coffeen used a half-yard Lorain also working as a clamshell. The Koehring swinging the skull cracker, mentioned above, was furnished by subcontractor L. J. Luteri.

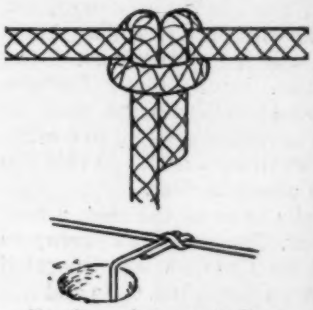
Utilizing the Railroad Grade

A mile or two west of the Mashuda operations, the Turnpike crosses and recrosses State Highway 31—a well traveled road between Mount Pleasant and Somerset. The Turnpike passes a few feet south of the little town of Donegal and here the traveler gets the first glimpse of the old South Penn Railroad grade. More than fifty years ago the railroad builders had put through one or two cuts the entire length of the pass to the south of Donegal and

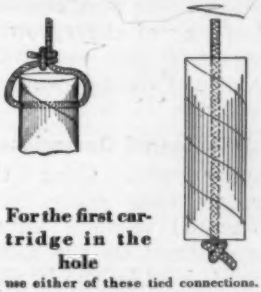
● **Top: Blazing a trail for the Turnpike, this clearing on the Mashuda contract heralds the advance of the heavy digging machinery soon to come. Bottom: Scraper, bulldozer, and roller prepare the fill along this stretch of Mashuda's contract. Note heavy rip-rap placed to protect the road's shoulder from the nearby mountain stream.**



For main line connections use a square knot

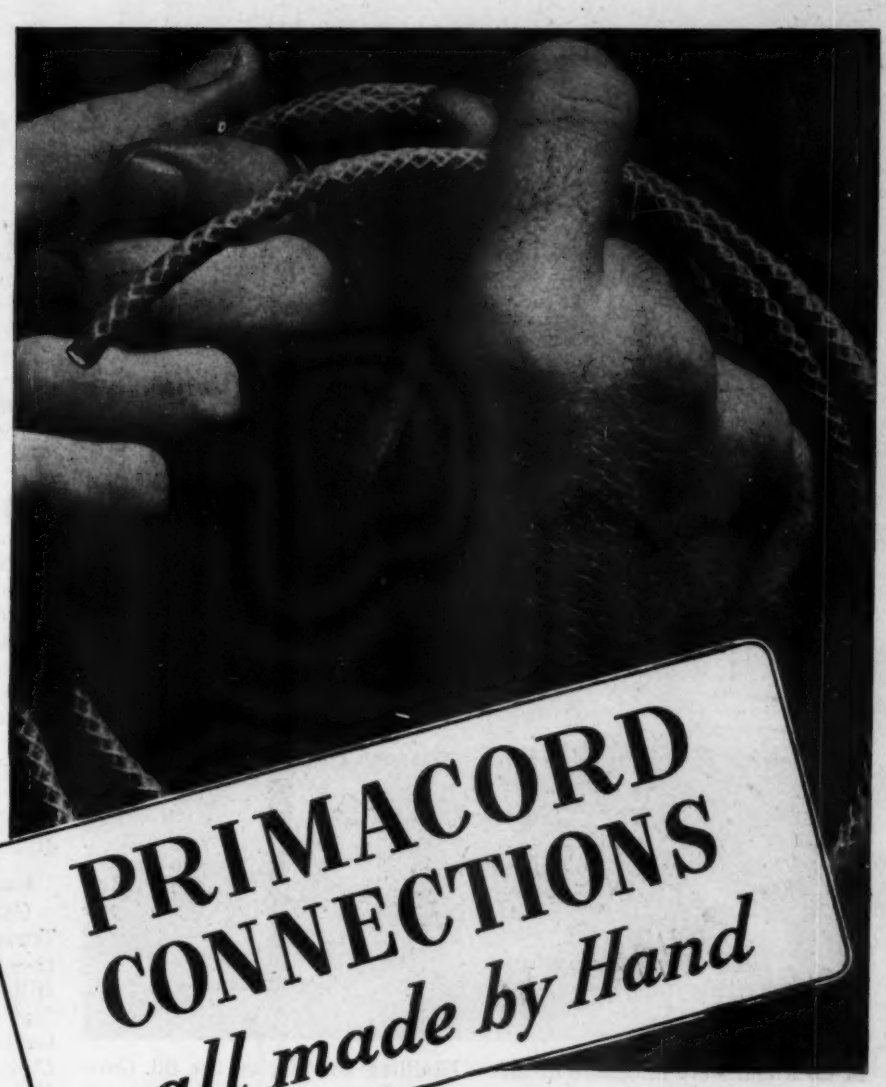


For branch-to-main line connections use a half hitch

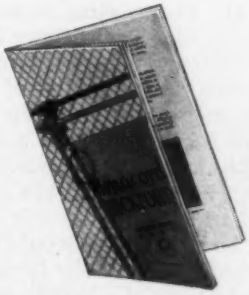


For the first cartridge in the hole

use either of these tied connections. First make sure that the Primacord is long enough to reach from the bottom to the top of the hole. Spliced or knotted Primacord should not be used in a drill hole, as the exposed ends might come in contact with water under pressure.



PRIMACORD CONNECTIONS ..all made by Hand



Simple, isn't it! For the main line use a square knot. For branch-to-main line use a half hitch. For the first cartridge in the hole use either of the methods shown, with a *continuous* length of Primacord, having *no* connections.

Primacord-Bickford is the *improved* Detonating Fuse with a flexible, waterproof textile cover. It is light, strong, easily handled, and "goes" at a speed of 20,350 feet per second!

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PB13

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● Top: "Mashudaville," located near Sommerset, Pennsylvania, was one of the few complete construction camps on the Turnpike. Bottom: Caterpillar RD-8 tractors towing 15-yard LeTourneau scrapers in fill placing operations alongside the old Penn railroad bed on the Adam Eidemiller contract.

at each end were on grade in this 60 foot cut for perhaps two or three hundred feet. As Donegal is approached from both west and east by climbing a gentle hill, the old railroad fill, now slashed of all its undergrowth, is seen reaching across the valley for 1,000 or perhaps 1,500 feet at both ends of the cut. Here Adam Eidemiller of Greensburg, Pennsylvania was just getting into real digging stride with shovels and scrapers. Two Koehring 701's were loading at each end of the Donegal cut, on the east end to four 8-yard Euclids and on the west end to five 3-yard Koehring Duptors. Seven Model F 15-yard LeTourneau Carryalls powered by Caterpillar RD 8's were also moving dirt on the west end of this cut. Six bulldozers, three Caterpillars (RD8, RD7, and RD6), one Allis-Chalmers 50 and two International Harvesters were handling the dirt on the fill. Care was taken to see that the new and old fill are properly "tied together" to prevent the new fill from sliding away from the well-settled railroad grade. This was done by "benching" with the corner of a bullgrader, thus neatly joining the two fills for proper drainage. These fills were rolled with ten-ton rollers in layers not to exceed 18 inches in thickness and all oversize rock was prohibited. The red shale which had a sandy appearance broke up nicely, however and oversize was not a problem here. Later on Adam Eidemiller expects to add Bucyrus-Erie 10-B, GA-2 and Koehring 601 shovels to speed up the digging on this contract.

Work was just getting started on the George Vang, Inc., contract, as we continued eastward. Subcontractor Corrado & Galiardi Construction Company was making plenty of noise (yes, and moving dirt) with throttles wide open on seven Caterpillar RD8's hauling LeTourneau Carryalls. An RD8 and RD6, equipped with bulldozers, were helping on both cut and fill, while a Caterpillar Autopatrol speeded up the work of the Carryalls. Four 10-ton Buffalo-Springfield rollers were used on the fill to reduce settling to a minimum. Both cut and fill on this job ran to about 35 feet.

A mile or so to the east, a fleet of four 12-yard Heil scrapers pulled by Cletracs was operated by George Vang, Inc. Cuts and fills at this point were just getting started and not far from this scene slashing crews were clearing the right-of-way of undergrowth. Two crews of 30 men each were clearing a mile of right-of-way per 40-hour week.

Laurel Hill Tunnel Operations

Continuing west along the Turnpike, we next encountered the one tunnel piercing Laurel Hill. The contract on the 4,400-foot tunnel is held by the Hunkin Conkey Construction Company of Cleveland, Ohio. Work on Laurel Hill tunnel is nearer completion than any of the other six tunnels and it will probably be the first one holed through.

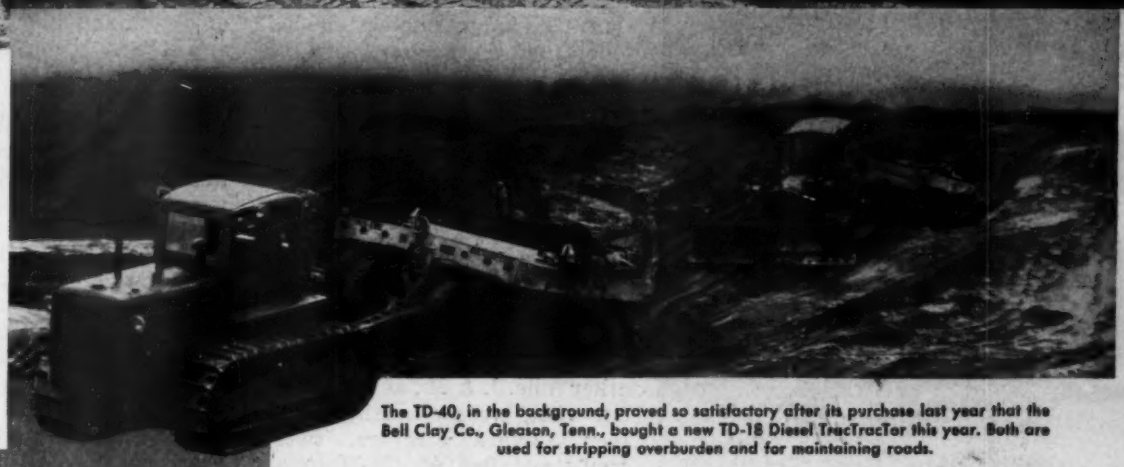
Under the active direction of F. A. "Al" Huntington, Superintendent, 125 men are working four 6-hour shifts daily. Drilling is done on one 6-hour shift and the mucking operations take up the following 6-hour shift in a continous 24-hour performance. The old South Penn railroad bore was in excellent condition on this tunnel and had been completed for a distance of 800 feet, the first 400 of which was of double track width and the second 400 of single track width.

Completing the 4,400-foot flat arch bore and enlarging it to 32 feet in width and 26 feet in height calls for the drilling and removal of 110,000 yards hard limestone

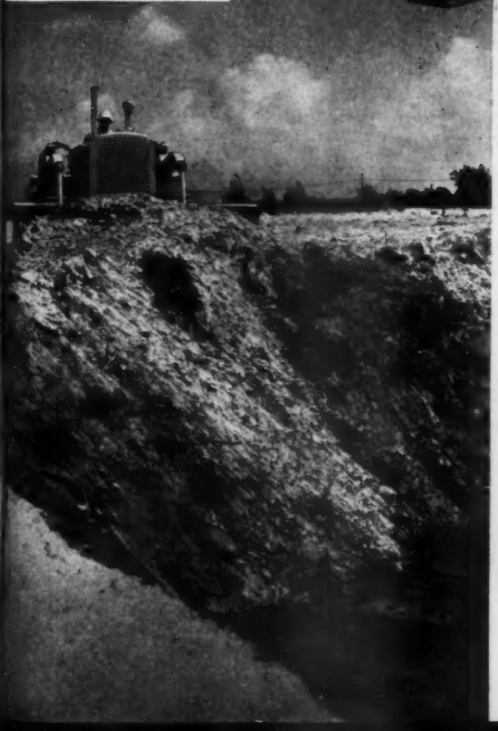
TAKE ON THESE *Profitable*

Above: The fleet's in on this highway job and the dirt moves fast. Four International TD-40 Diesel TracTracTors with 4½-yd. scrapers step up the yardage and step down the costs. It pays to standardize on International any way you figure, as contractors everywhere are learning.

Below: How to do an efficient back-filling job—use a TD-40 Diesel with bulldozer, as Jack Quinn, Inc., Miami, Fla., contractors, are doing to fill this quarry from which coral rock was removed for building roads.



The TD-40, in the background, proved so satisfactory after its purchase last year that the Bell Clay Co., Gleason, Tenn., bought a new TD-18 Diesel TracTracTor this year. Both are used for stripping overburden and for maintaining roads.



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It's this unequaled *performance-per-dollar* that is turning the tide to International.

When you go over TracTracTor design and construction, you'll see feature after feature . . . all engineered into these units to keep a higher percentage of the maximum drawbar horsepower continuously applied to get the most work done per day at the lowest possible cost.

Get the benefits of International Harvester's experience as the world's leading maker of tractors. Put your power problems up to the nearby International industrial power dealer or Company-owned branch. And be sure to see the new 70 h.p. (drawbar) TD-18 Diesel TracTracTor—it's way out ahead in the big heavy-duty field.

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and shale. Using Ingersoll-Rand, Sullivan, and Gardner Denver drilling equipment 10 to 12-foot holes are drilled moving 270 yards per "round." The tunnel is being cut full face and will have a 2% grade from West to East. It is estimated that about 25,000 pounds of Hercules powder will be used on this tunnel.

A 1¾-yard Lorain electric shovel with a 14-foot boom and 11-foot sticks and 24 seven yard dump cars pulled by two Vulcan locomotives are being used to get the blasted rock out of the bore.

Connell & Laub's Section

At the western end of Connell & Laub Construction Company's contract—approximately one-half mile from the eastern portal of Laurel Hill Tunnel — subcontractor E. Arthur James (Johnstown, Pennsylvania) was loading to four 3-yard Koehring Dumptors with a 1¾-yard Koehring shovel. From this point for a distance of 12.5 miles eastward, Connell & Laub have three adjoining contracts involving nearly $1,500,000. On these, E. Arthur James subbed approximately one mile of work, and Jacobsen & McKinley had another mile. J. & M., at the time of our visit, were operating seventeen 12-yard scrapers, twelve Heil's and five Austin-Westerns. Cletracs furnished the power. This subcontractor had moved much of the 365,000 yards of his contract, and finished or nearly-finished grade extended almost the entire length of the Connell & Laub contract.

On these contracts, Connell & Laub had eight shovels as follows: Three Osgoods of 1¼, 1¾, and 2 yards capacity, one 2-yard Northwest, one 1½-yard Lorain Diesel, one 1½-yard Lorain 75 gas, one ¾-yard Lorain gas and one ¾-yard Bay City. Handling the output of these machines we found ten 11-yard Euclid's, six bottom dump and four end dump, and six 7-yard Linn tractors. Augmenting this hauling equipment when needed were ordinary trucks of various capacities rented locally. The deepest cut on the Connell & Laub contracts amounted to approximately 70 feet and from the five major rock cuts a total of 346,000 yards were removed. For the most part this contractor worked three 8-hour shifts and employed as many as 500 men at one time. Miscellaneous equipment found on the job includes one International TD18, three Caterpillars and eight Allis-Chalmers tractors, all equipped with bulldozers. Ingersoll-Rand compressors furnished the air for the drilling in the rock cut.

A good share of the Connell & Laub work followed a new location some distance from the original South Penn railroad line. This is only natural since the Turnpike's larger cut and fills permit a much more direct route. It is interesting to note here that the Turnpike's relocation leaves for posterity one of the nine unfinished tunnels, known as the Quemahoning which was originally a part of the old Penn railroad's plan. This abandoned, unfinished bore lies approximately 2½ miles northeast of Somerset, not far from the present Turnpike location.

● Seen along the Turnpike: (1) Floodlight mounted on wooden tower for night operations. (2) Temporary water reservoir for sprinkler trucks. (3) Bucyrus-Erie Bullgrader gives a helpful shove. (4) LeRoi light plant provides power for night illumination. (5) Built-in button on Gar Wood bulldozer blade for scraper pushing. (6) A Novo pump bails out the water. (7) One of the coal veins that ran under the Turnpike.

Turnpike Coal Mines

A problem of significance, encountered a number of times in building the Turnpike road bed, was found on the Connell & Laub contract near the Bakersville Road separation. At this point the Marybelle Coal Mine was encountered. The method of handling these coal mines so the Turnpike traffic would not be endangered from cave-ins involved first the opening up and removal of all coal in the right-of-way. Where the mine had been abandoned and conditions were suitable, after cleaning out enough coal to remove a

We sure keep our shovels busy and our trucks rolling with those Bucyrus Erie Blast Hole Drills on the job.
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fire hazard, the mine was backfilled. In the abandoned mines where conditions would not permit this and in active mines the plan was to block up carefully by hand with large boulders placed so that seepage would not wash the Turnpike fill down into the mine. These coal mines in the right-of-way kept Turnpike geologists busy checking all factors for the protection of the finished Turnpike.

Although coal was encountered many places by those excavating for the Turnpike, there were only four extensive coal workings which gave concern. The largest of these is at Isman's Run not far from the western end of the Turnpike. Immediately west of the Mount Joy cut on the Guthrie-Marsch-Peterson contract the Zellmora Mine was encountered, and one mile east of Somerset on the contract adjacent to Connell & Laub (County Construction Company) a coal mine was found on the Coffee Springs Farm. The method of handling the excavation at each of these four coal mines was approximately the same as we have described above in the case of the Marybelle Mine.

The grading, drainage and structures on the 7.55 miles of Turnpike east of Connell & Laub's contract, was that of County Construction Company, Carnegie, Pennsylvania. The important item of this contract which aggregates almost $700,000 is the 65-foot rock cut which will eliminate the use of the original Negro Mountain Tunnel planned by the South Penn Railroad. This rock cut involves approximately 258,000 yards and at the time of our visit was approximately six feet from grade. Shovel equipment on this contract includes: Lorain 77, 79, and 30, Manitowoc Speedcrane, Lima 601 and 101, Bucyrus-Erie 7/8-yard steamer, and two Koehring clamshells. Scraper equipment includes one LeTourneau Carryall and Caterpillar tractor, two Heil 12-yard scrapers with Cletrac tractors and three 12-yard Austin-Westerns also pulled by Cletrac. Cat 30's pulled Galion graders on the unfinished grade and fill and six 10-ton Galion rollers were used for compacting. Three Cletrac and one Allis-Chalmers with bulldozers completed the tractor equipment. The major part of the hauling was done by rented trucks, but the contractor had three 12-yard Euclid bottom dump trailers working in the rock cut.

Opening Up the Allegheny Tunnel Faces

Continuing East, we approach the west portal of Allegheny tunnel where preparations are being made to start the actual bore. Guthrie - Marsch- Peterson Company holds the $2,672,188 contract on this tunnel which calls for 1.86 miles of excavation including the east and west approaches of the tunnel. Upon examination of the unfinished tunnel, the contractor found conditions so bad that it would not be possible to complete the old tunnel at a lower figure than the drilling of an entirely new tunnel. Thus, though approximately one-third of the old bore had been open from both portals, Allegheny Tunnel is the only one of the seven included in the Turnpike project where advantage is not taken of the work done 50-odd years ago. The new tunnel parallels the line of the old tunnel approximately 85 feet to the south.

On the west portal a Bucyrus-Erie 48-B was busy making a 40-foot cut to open up the tunnel face. About 147,000 yards are being moved in this operation with the aid of Ingersoll-Rand drilling equipment consisting of 2 com-

● Top: Hunkin-Conkey Company men raise a steel section of a "California switch" to be used in tunneling operations on the Laurel Hill bore. Bottom: Connell & Laub's 2-yard Osgood loads large size rock to trucks in this deep rock cut.

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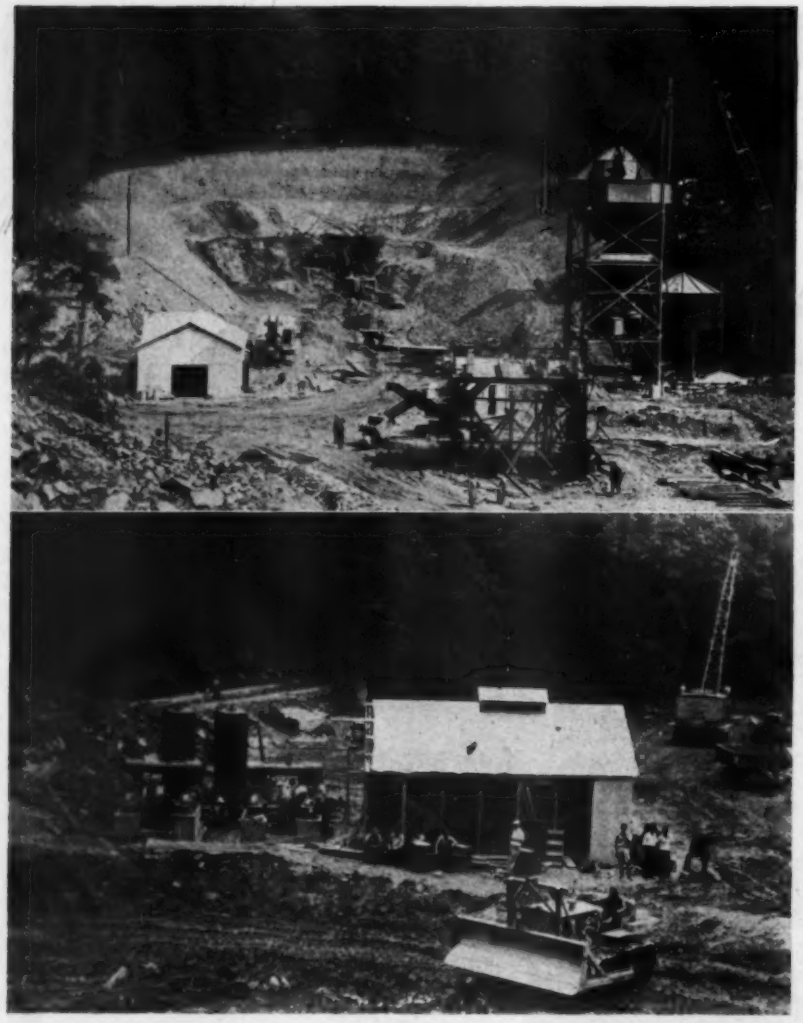


● Top: Looking across Gunter's Valley at the west portal of Blue Mountain tunnel. Note the large Smith batching plant at the right. Bottom: View of Ingersoll-Rand stationary compressor on the east portal of the G-M-P Allegheny tunnel contract.

pressors, 2 wagon drills, and 2 jackhammers. Hauling from the 48-B to the fill was handled by 4 Caterpillar-towed Athey wagons. Two LeTourneau bulldozers mounted on Caterpillar RD-8 tractors and 2 Huber rollers were grading and compacting the fill.

Piles for a floating drainage arch located on the west approach were being driven by a Bucyrus-Erie 37-B rigged as a pile driver. Ingersoll-Rand stationary compressors powered by General Electric motors were being installed at each portal of the tunnel for bore drilling operations.

At the east portal grading and drainage operations on the tunnel approach were being handled by two shovels, a Speeder and a Northwest, and a Bucyrus-Erie dragline. Grade calculations at this point proved that the old South Penn railroad builders had done their job well for in fifty years the fill of the old railroad bed had settled only ½-inch.

The west portal of Allegheny Tunnel is the entrance to Pennsylvania's western highlands and the eastbound traveler, having just passed through the rugged Laurel Hill region farther west, might question the need of a tunnel approximately 6,000 feet in length at this point. A view of the surrounding country from the east portal, however, is in such contrast with the gentle slope at the west portal, that our eastbound traveler might well wonder if even a 6,000-foot tunnel and a descending grade of not more than three per cent (plus cut and fills that are cuts and fills) will enable him to reach the floor of the Juniata River valley below.

Move Old Railroad Fill

One of Guthrie-Marsch-Peterson's first problems at the east portal was the removal of the old fill put in by the builders of the South Penn railroad at the very "doorstep" of the tunnel. This was necessary because it was determined that a larger concrete arch at the bottom of the run some 90 or 100 feet below the highway grade would be required. A Speeder and a fleet of trucks together with a Caterpillar-mounted bulldozer and Huber roller were making quick work of the old fill.

In charge of tunneling for G-M-P at the east portal, is H. J. "Pat" McCune whose experience in tunnel work dates back many years. Unusual safety precautions must be taken on this phase because of the many minor faults due to the general dip of the strata and the gravitational pulling apart of the beds along their bedding planes. Arch ribs in half sections will be installed to give an immovable roof so that mucking operations can be carried on in safety.

Mucking will be handled by two Bucyrus-Erie 33-B electric tunnel shovels. These machines are equipped with 17-foot booms, 14' 1½" dipper sticks, and carry one and one-half yard rock handling dippers.

The amount of the contract east of Allegheny Tunnel gives a clue to the depth of the cut and the height of the fills. Central Pennsylvania Quarry Stripping & Construction Company bid $1,561,920.63 for this 7.27 mile section in the heart of the Turnpike's most beautiful scenery. Considering the fact that this contract contains no major structures (such as New Stanton or Arona Viaducts) it is one of the costliest grading jobs undertaken by the Turnpike, probably exceeded only by Clear Ridge and Mount Joy cuts described elsewhere in this article. At the time of our visit the contractor had just moved in

...THAT SHEAVE HAS CHEWED UP ITS LAST WIRE ROPE!

FROM THE DAILY REPORT OF A TIGER BRAND WIRE ROPE ENGINEER

No sooner stepped in here this morning when the super had me by the ars. "Come with me," he said, "I want to show you something."

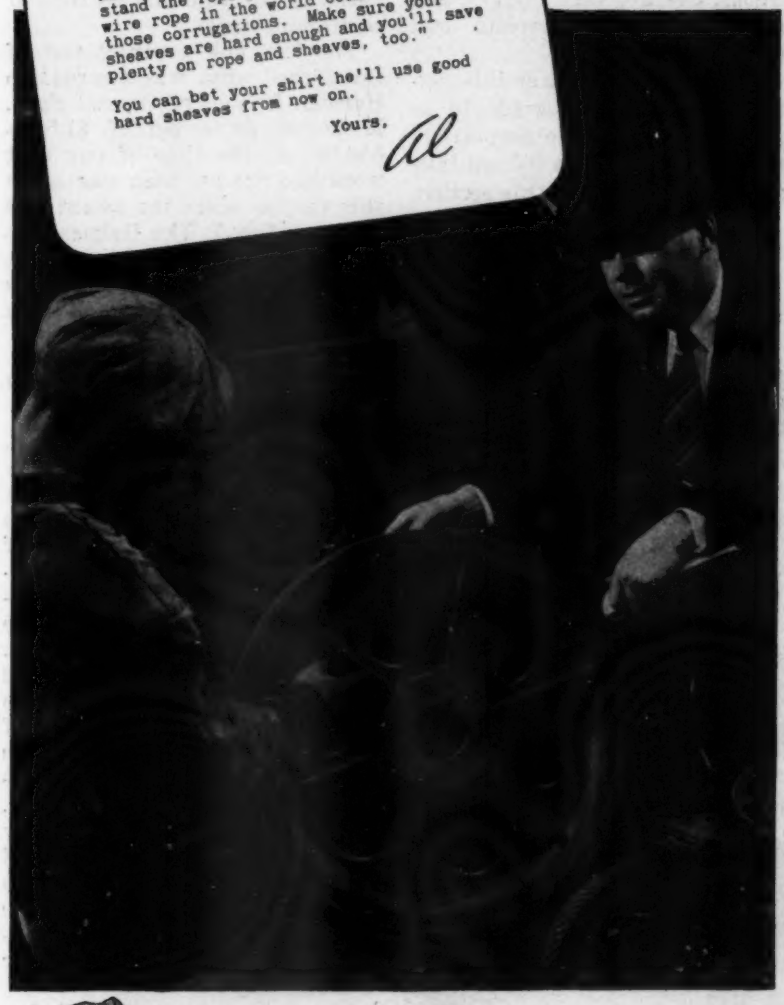
At the scrap pile he pointed at a discarded sheave. "There's a sheave that has chewed up its last wire rope," he said. "Only a few months old but it's already ruined two ropes."

I could see it was badly corrugated. "The trouble with that sheave," I told him, "is that it wasn't hard enough to stand the rope pressure. Why, the best wire rope in the world couldn't last on those corrugations. Make sure your sheaves are hard enough and you'll save plenty on rope and sheaves, too."

You can bet your shirt he'll use good hard sheaves from now on.

Yours,

Al



THE material from which a sheave is made should be hard enough to withstand the wear caused by the pressure of the rope on the sheave groove. Sheaves made from too soft material not only wear rapidly, but also shorten the rope life, because the deepened grooves do not provide working clearances for the rope. The resultant pinching of the rope imposes a binding action which prevents proper load distribution, and causes excessive internal and external friction. Corrugations from strand and wire impressions further reduce rope life by accelerating wear.

Limiting values of the pressure between a rope and sheave to secure satisfactory service have been established for all common materials from which sheaves are manufactured. If you are encountering undue sheave wear, our Engineering Department will gladly help you determine the pressure on your sheaves and make money-saving recommendations based on these standards.

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on the job, having been awarded this section on July 6, some three weeks prior to our visit. A number of bulldozers were working on the task of clearing the right-of-way and on a long haul job a Northwest was loading to Euclid bottom dump trailers. In this same cut two LeTourneau Carryalls pulled by Caterpillar RD8's were carrying their heaping loads onto the fill. A half dozen or so LeTourneau Carryalls, several Caterpillar graders, a number of 10-ton rollers, several bulldozers and another Northwest shovel had just been hauled into the job and were waiting alongside the right-of-way to be put to work. A Bucyrus-Erie 10-B was also found on this job, "down in the hole" digging an outlet for a 7-foot drainage pipe.

Girard Company Nears Contract Completion

The second contract for structures grading and drainage let by the Turnpike Commission (November 29, 1938) was that of the Girard Construction Company, Inc., award for the 9.6 mile section next visited. Grading and structures on this contract were almost completed. Cleaning up odds and ends were an Osgood, handling a 2-yard Amsco dipper, and a Lorain 77. These shovels were loading to six 6-yard International trucks, five 2½-yard Dodges, and several Fords, Chevrolets and Whites.

There were ten cuts on this contract ranging from grade to as deep as 86 feet. The deepest fill was 60 feet. The cuts did not take care of all the fills on this section, approximately 50,000 cubic yards having been borrowed. Fourteen other structures, including two overpasses, were included in the Girard contract. All of these were completed except for the decks.

Six structures on this section were bid separately and awarded to N. B. Putman Company of Harrisburg. Grading and drainage for these structures were also included in the Putman contract. This job was practically finished with the exception of the Juniata River bridge. Three 48-foot spans required approximately 100,000 yards of concrete and 55 tons of reinforcing steel.

The 7.13 mile contract east of the Girard work was awarded to Herman Holmes of Crystal Falls, Michigan, on a bid of $1,513,-504.98. At the time of our visit work had not yet been started on this section, since the award was made on July 7. The Holmes contract includes the grade separation where the Turnpike crosses U. S. Highway 30 as well as a number of other structures.

Three Structures by M. Bennett & Sons

Just out of Bedford to the east, M. Bennett & Sons, Indiana, Pennsylvania, have a 1.293 mile contract involving $496,532.36. This contract consists in the main of three structures, a railroad underpass, a highway underpass and—the largest structure of the three—a viaduct over Dunning Creek. These three structures will require approximately 9,000 cubic yards of concrete and 1,500,000 lbs. of structural steel. Work on the railroad underpass was progressing nicely at the time of our visit. Concrete was being furnished by a Koehring 27-E paver. Two P&H Model 700 cranes converted from shovels were used in placing the steel and swinging the Insley 1-yard concrete bucket from paver to forms.

The Bennett contract includes,

● **Top: General operations view of the west portal of Allegheny tunnel. A Bucyrus-Erie 48-B loads to Cat-drawn Athey wagons and at the right drilling operations are carried on for the next blast. Bottom: Fill placing operations on the Empire Construction Company contract.**

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Says

PHOENIX-TEMPE

They add, "It is fast, easy to handle, economical to operate, and dependable." And they back up their statement by getting an average hourly output in gravel of 125 bank yards . . . Every gear in the 20-B machinery (except main swing rack and pinion), as well as the silent roller chain engine transmission, is completely enclosed and runs in oil. This Bucyrus-Erie feature means long life, top output and bottom maintenance.

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● Looking east along Frank Mashuda's section of the Pennsylvania Turnpike gives one a good idea of the rugged terrain in this section.

in addition to the structures, considerable grading for which two 1½-yard shovels, one an Osgood and the other a Lorain were on hand. At the time of our call these machines were starting the side hill cut across the Raystown Branch of the Juniata River, and viewed from the Lincoln Highway appeared to be holding on to their precarious side hill positions with the use of "sky hooks."

Re-location of Juniata River

Also included in this contract is the re-location of the Juniata River branch for a distance of approximately 1500 feet. This work was handled by subcontractor Oblock Construction Company of Unity, Pennsylvania, who had a 1¾-yard Lorain and a ¾-yard Bucyrus-Erie loading to rented trucks. Two International "40" tractors with Bucyrus-Erie bulldozers were also on this job. To re-locate this stream a cut from some 8 to 13 feet had to be put through. The material was wet, sticky clay and the total yardage involved was about 50,000. This was moved in 5 weeks' time in spite of about 15 days of rain. Two 7-hour shifts per day were worked.

The viaduct across the Raystown Branch of the Juniata River at its junction with Dunnings Creek will be more than 400 feet long—one of the major structures on the Turnpike.

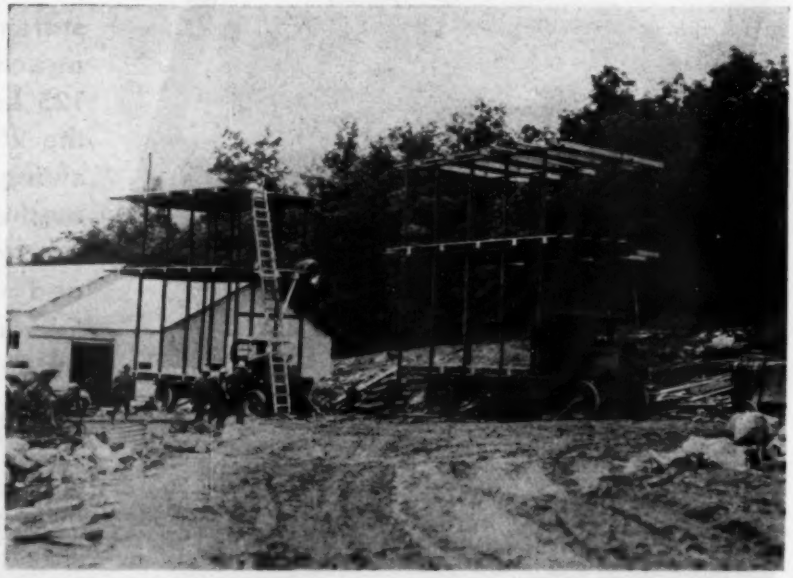
York Engineering Company of York, Pennsylvania, took the next two contracts, the one adjacent to the Bennett Contract mentioned above involves a viaduct over U. S. Highway 30. The length of this contract is .77 miles and the award was made at $326,209.62. Next contract to the East, also held by York Engineering Company, is for 2.47 miles of grading, drainage and structures. On this work, although the contractor had not gotten into full swing at the time of our visit, a Lorain 75-A, a 2-yard Northwest and 3 LeTourneau carryalls pulled by Caterpillar tractors were moving dirt. Hauling equipment included several Euclid diesel powered Trac-Truks as well as some Reos. A Bucyrus-Erie TD-40 Bulldozer was also on this job.

The next two contracts are those of Nello L. Teer, Durham, North Carolina, and N. R. Corbisello, Binghamton, New York. The Nello L. Teer job had been awarded on July 6, and this contractor was just moving in. Several times in the next few days we encountered equipment belonging to him, which was being moved in from the job he had just completed between Rays Hill and Sideling Hill tunnels farther East. There are some heavy cuts in this Nello L. Teer contract, one of them running as high as 106 feet in depth.

Largest Cut on Turnpike

The Corbisello contract has been widely publicized because it includes the largest cut on the entire Turnpike. Painstaking care was taken by Turnpike officials to make sure that an open cut would be more economical than the tunnel which at first was thought to be necessary. The old South End railroad line made a detour around Clear Ridge, after which this cut is named. The location of the highway through Clear Ridge saves approximately 1.2 miles and eliminates the otherwise necessary sharp curves. The cut will be 150 feet, 380 feet wide at the top, and approximately 2,600 feet long. More than 1,115,000 cubic yards of earth and rock will be moved to make this largest of all cuts on the Turnpike. The material from the Clear Ridge cut will be used in the largest fill on the Turnpike. Its length is approximately 3,000 feet and it will be 100 feet deep at the deepest point. Two drainage structures and one road underpass are required by the fill. A 370-foot arch to permit the passage of a small stream is the longest of the structures. A twin span arch 328 feet long will carry the Turnpike

● These two double-decked drilling jumbos mounted on Mack trucks will work side-by-side in Sideling Hill tunnel boring operations on the Arundel Corporation contract.



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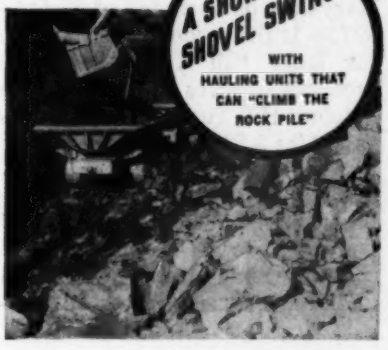

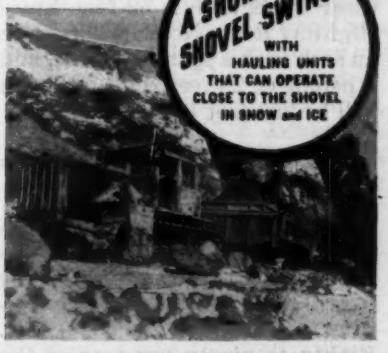

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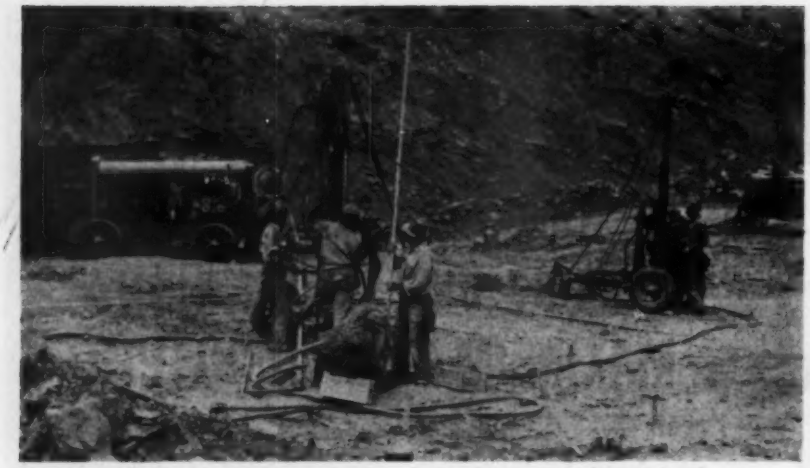


● Using Ingersoll - Rand wagon drills and compressors G-M-P blasts its way through the heavy rock cuts.

over Clear Creek. The span of the Clear Creek arch is 52 feet. State Highway Route No. 26 will require an arch with a span of 36 feet, and a height of 29 feet. This overpass will be 286 feet long.

Empire Construction Handles Lots of Rock

Largest cut on Empire Construction Company's contract is 76 feet, containing about 230,000 yards. An 86-foot fill on the contract will call for 225,000 yards. Eighty to ninety per cent of the material handled is rock and necessitates constant blasting operations.

Two Bucyrus-Erie 43-B's and two Koehrings, a 303 and a 701, are handling the heavy rock, loading it to a fleet of 13 Caterpillar-towed Athey wagons and about 15 trucks of various makes. Seen in action on the several fills of the contract were Caterpillar-mounted LeTourneau bulldozers and rippers, Buffalo-Springfield 10-ton rollers, and a Bucyrus-Erie bulldozer mounted on an International "40."

Under construction on this contract was a typical large drainage structure over Brush Creek. These structures were usually sublet by the major contractors and in this instance the arch construction was let to John F. Keelor of Everett, Pennsylvania, by the Empire Company. Constructed in two 52-foot spans the structure is 180 feet long and 130 feet wide. It contains 2,100 yards of class A concrete and 1,960 yards of class B reinforced by 308,000 pounds of steel. A Koehring 27-E paver poured a maximum of 232 one-yard batches in 11 hours during concrete placing operations. The 2,200 yards of excavation necessary for the foundation of the structure were handled by a ⅜-yard Bay City.

The last contract to be awarded by the Turnpike Commission for "structures, grading and drainage" which adjoined the Empire Construction Company contract on the east went to L. M. Hutchison, Mount Union, Pennsylvania. It is interesting to note that Mr. Hutchison was also awarded the Turnpike's first grading and drainage contract on October 27, 1938. This section, near the eastern end of the Turnpike, is now complete, and the contractor is now at work on his second section lying just west of Tuscarora Tunnel which will be described in brief below.

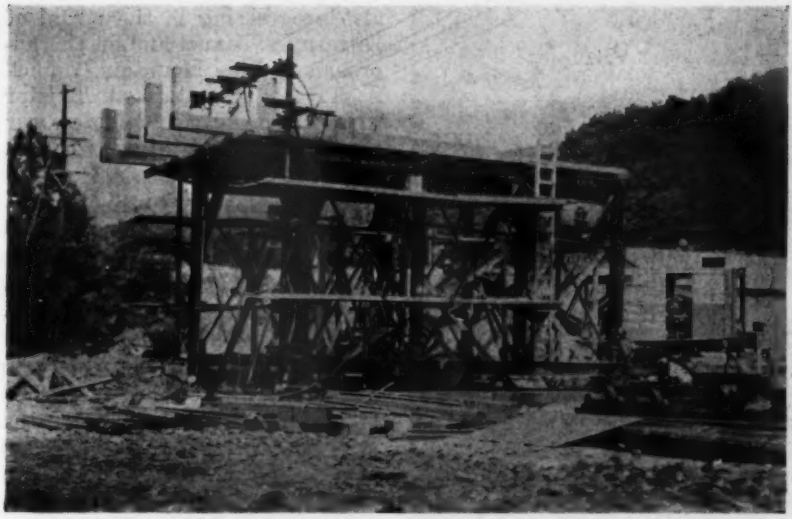
The last contract taken by Mr. Hutchison involves 2.72 miles of highway and includes seven structures plus the "Breezewood Interchange" which is the last place the Turnpike crosses the Lincoln Highway.

Rays Hill and Sideling Hill Tunnels

Two tunnels follow in quick succession. Rays Hill Tunnel awarded to Mason and Hanger Co. of New York City on their bid of $1,549,718.50 is the first, and Sideling Hill Tunnel awarded to Arundel Corporation of Baltimore, Maryland, on their bid of $2,444,-527.25 is the second. The contract for Rays Hill Tunnel and approaches involves 1.33 miles while Sideling Hill Tunnel and approches call for 2.526 miles. Between the two tunnel contracts, for a distance of 2.924 miles the grade has been completed by Nello L. Teer of Durham, North Carolina.

At the time of our visit Mason and Hanger was engaged in "fac-

● Empire Construction Company's Bucyrus-Erie 43-B tackles some tough rock digging.



● This rail-mounted drill jumbo is being used by Bates & Rogers on their Kittatinny and Blue Mountain tunnel boring operations.

ing-up" on both approaches. Work on the east approach had advanced a great deal farther than that on the west approach, but the contractor felt confident of completing his contract in the allotted time in spite of the bad breaks in weather received the previous three weeks. Arundel Corporation on the west portal of Sideling Hill Tunnel had about 180,000 yards to remove in the approach to the tunnel proper and this work was practically completed at the time of our visit. Two drill jumbos consisting of 3½-inch steel pipe, welded were in process of construction on the frames of two old Mack trucks. These will be used side by side in the bore drilling operations. Mucking will be carried on by a Marion 371 converted from a diesel to an electric shovel in the Arundel Corporation field maintenance shop. A 2-yard dipper has also been installed to increase the former 1¾-yard capacity. Boom and dipper sticks had also been shortened. On the east portal of Sideling Hill Tunnel a Lorain 40 and 1¾-yard Marion were finishing up the approach.

The first contract east of Sideling Hill Tunnel was held by C. J. Langenfelder & Son, Rosedale, Maryland, who bid this 6.91 mile of Turnpike at $418,813.89. The next contract, 1.96 miles went to Dalton Bros., Inc., Paoli, Pennsylvania, for $234,593.00. This includes the grade separation for highway 522 between McConnellsburg and Mt. Union.

One of L. M. Hutchison's Sections

Another typical grading and drainage section on which L. M. Hutchison of Mount Union, Pennsylvania, holds the contract was visited next.

On this 5.54 mile contract 754,000 yards of rock and dirt were being handled by a modern, well cared for line-up of fast moving equipment. Heading the shovel line-up were 5 Bucyrus-Eries, a 44-B, three 10-B's, and a ¾-yard steamer. The 44-B and one 10-B were rented from Roy Maxwell of Newton-Hamilton, Pennsylvania, who actively supervised their operation. A 1-yard Northwest and a 1¼-yard Lorain diesel complete the dirt and rock digging equipment.

Three 12-yard Euclid scrapers paired up with 4-wheel rubber-tired Euclid tractors did some fast dirt hustling on the Hutchison contract. A Cletrac-mounted Gar Wood bulldozer with a specially built pushing button on its blade was necessary to push these scrapers during loading operations. Once loaded, however, they rambled down the grade to the fill at about 25 miles per hour. Six 12-yard Heil scrapers, 3 towed by Cletracs and 3 by Caterpillars, also scooped out plenty of dirt on this contract. Two rippers, a Gar Wood and an L. B. Smith, were used on the contracts to loosen up the hard spots.

Building the fills were three Gar Wood bulldozers mounted on Cletracs, two Allis-Chalmers graders, and four 10-ton Buffalo-Springfield rollers. Night operations were made possible by the use of three Homelite electric plants which supplied the necessary illumination.

Under the active direction of Mr. Hutchison about 10,000 yards a day were being moved by the entire Hutchison equipment line-up. Shovels were working two 7-hour shifts a day and scrapers three 7-hour shifts.

The L. M. Hutchison contract is adjacent to the Tuscarora Tunnel which was awarded to B. Perini and Sons, Inc., Framingham, Mass., who bid $2,055,939.67. The tunnel and approaches cover 2.05 miles of the Turnpike. Work on both approaches of this tunnel was proceeding rapidly, but drilling operations have not been started.

The next contract, 9.54 miles, was awarded to C. J. Langenfelder & Son on their bid of $31,466.88 and extended from the

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● A Conte-Eastwood Co., Inc., Lorain 77 swinging a 1¾-yard Amsco dipper loads to an 8-yard Euclid Trac-Truk in a shallow cut.

east approach of Tuscarora Tunnel to the west approach of the "twin tunnels" at Kittatinny and Blue Mountains. Work on this contract was proceeding with the building of structures and grading operations were in progress at several points on the contract.

Bates and Rogers Hold Largest Contract

Traveling eastward, just before reaching the broad, level stretches of the Cumberland Valley, we arrive at the last two tunnels on the Turnpike, Kittatinny and Blue Mountain. Separated by Gunter's Valley, site of the Shippensburg watershed, the portals of the two tunnels are only 800 feet apart. Construction of Kittatinny and Blue Mountain tunnels and their approaches was awarded to Bates and Rogers Construction Corporation of Chicago for $2,920,123 and is the largest contract on the Turnpike

Kittatinny Tunnel is approximately 4600 feet between portals, of which 1850 feet of double track section and 2150 of single track section had been driven by the builders of the old South Penn Railroad. Thus the principal work will consist of the enlarging of the already existing bore and the excavation of approximately 600 feet in holing through. The west approach and the west half of the Kittatinny Tunnel have been sublet by Bates and Rogers to Boxley Bros.-Sammons & Robertson Company who are well qualified to undertake this type of work. Work on the west approach of Kittatinny Tunnel was proceeding rapidly at the time of our visit. A large concrete arch was being put in about 1000 feet from the tunnel portal so that the fill could be extended.

In Gunter's Valley where Bates & Rogers have stationed their construction camp work was already in progress on the east half of Kittatinny Tunnel under the supervision of M. Hjalmarson, tunnel superintendent. Work was also progressing in the portal of Kittatinny Tunnel and on the approach to Blue Mountain Tunnel. A TD-40 International Tractor with Bucyrus-Erie bulldozer was cleaning up around the east portal of Kittatinny, and a Marion 361 shovel was loading to three crawler mounted wagons (two Atheys pulled by Cats and one Euclid pulled by International TD-18) on the west approach of Blue Mountain Tunnel. Dirt was being hauled perhaps 200 feet north of the Turnpike right-of-way and piled for later disposition. Here a Bucyrus-Erie 50-B steamer rigged as a crane was setting up a Smith batch plant to be used later on in supplying concrete for the tunnel. A drilling jumbo was in process of completion. It will work on track and is constructed of heavy steel "I" beams to give a safe and sound support to the drilling crews. Three Marion 42 electrics with short booms and sticks will be used in mucking out.

Hauling from the tunnel face will be in narrow gauge dump cars with storage battery locomotives used inside the tunnels and gasoline locomotives outside.

Work On Blue Mountain Tunnel

Blue Mountain Tunnel which is just short of 4200 feet from portal

● Loading to 3-yard Koehring Dumptors, E. Arthur James' 1¾-yard Koehring handles a rocky cut.

to portal had previously been opened almost 1800 feet for double track and a little over 1200 feet for single track. Completion of this tunnnel will find the Bates & Rogers organization finishing the western half of the bore, while Boxley Bros.-Sammons & Robertson has subcontracted the eastern half of the tunnel. Asheville Construction Company received a subcontract for the east approach to Blue Mountain Tunnel and were only about half through with their work at the time of our visit. A 1¾-yard Marion shovel was loading to three Euclid Trac-Truks. An Allis-Chalmers pushing a bulldozer was busy on the fill.

The Turnpike east of Kittatinny and Blue Mountain Tunnels reaches out into the broad, gently rolling Cumberland Valley. It is here that the first grading section of the Turnpike was awarded to L. M. Hutchison of Mount Union, Pennsylvania—a 9.54 mile contract at $458,058.80. This section was being given final inspection at the time of our visit, and it was possible to drive at a comfortable speed on the unfinished Turnpike grade. Between the Hutchison contract and the east portal of Blue Mountain Tunnel, H. W. Shaull of Mechanicsburg was working on a 4.92 mile section which was awarded to him at $287,833.77.

East of the Hutchison section, John H. Swanger of Lancaster, Pennsylvania was awarded 6.70 miles at $1,114,324.24, and Johnson, Drake & Piper, Inc., of Freeport, Long Island, New York, took 5.38 miles at $1,213,588.88. Both these last two contracts awarded on August 1 include the reinforced concrete paving as well as structure, grading and drainage.

PART III

What the Turnpike Will Mean

To the layman the building of a highway may seem to be a problem of digging, hauling, fill settlement, and maintaining a grade, with the laying of concrete completing operations. But behind these operations is the equally important task of securing the right-of-way. Where the property is already owned by the public, this problem is a simple one; where the ownership of property rests in the hands of many different individuals, estates, and even corporations, it becomes a serious and oftentimes discouraging battle to secure the proper title for a complete right-of-way. While the birth of the "all-weather" Turnpike idea unquestionably springs from the fact that railroad builders planned a "highway of steel" across Southern Pennsylvania two generations ago, only a small part of the present Turnpike right-of-way was secured from the Pennsylvania and Baltimore and Ohio Railroads into whose hands the titles eventually passed after the abandon-

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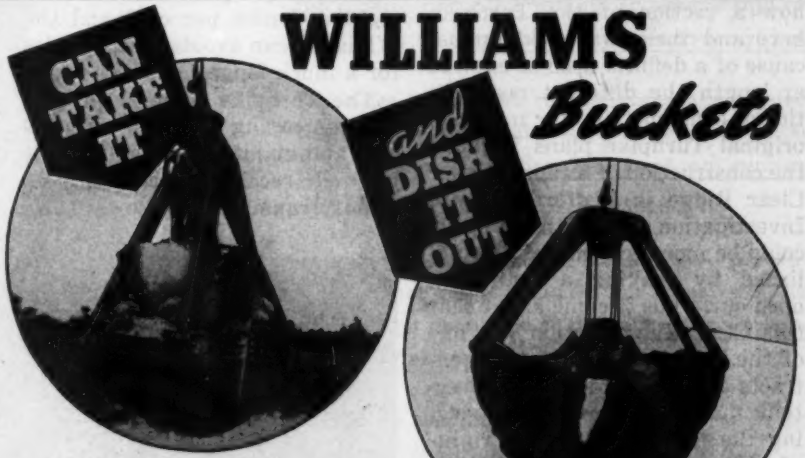

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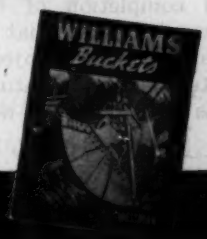

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● A view of the finished grade on the L. M. Hutchison contract. This rigid frame overpass was the first one completed on the Turnpike.

ment of the railroad project. These properties were principally the tunnels and their approaches —property which could be utilized for little else than a railroad or a highway unless it be for the stringing of high-powered transmission lines. Only approximately 89 miles of the entire Turnpike right-of-way was thus secured. Therefore it is not difficult to imagine the struggle to secure the proper right-of-way which the Turnpike Commission must have had in many instances, and great credit is due the men who have executed their assignments in so short a time. You have read above how a section of the Turnpike here and there was held up because of a definite need to explore at length the different possibilities of construction. For instance, original Turnpike plans included the construction of a tunnel under Clear Ridge in Bedford County. Investigation showed that a grade could be more economically established by making a mammoth open cut. Thus it came about that this Clear Ridge section was one of the last of the excavating contracts to be awarded. Other sections may have been held up pending the acquisition of the right-of-way, but viewing the project as a whole we say "hats off" to the people of Pennsylvania for their vision in making possible the rapid completion of this great highway project. That occasional opposition to the project was encountered is only natural, but it seems to us that all who live on or near the Turnpike will soon join in the cheering.

Advantages of New Route

In surmounting the massive ridges of the ancient Appalachian mountains, age old barrier between the Atlantic seacoast and the Middle West, Pennsylvania's superhighway will solve a serious east-west travel problem across the state. The present major highways, the Lincoln (U. S. 30) and the William Penn (U. S. 22) present many limitations on direct, fast travel. The Lincoln, which winds directly across the mountains has grades as steep as eight and nine per cent and the William Penn avoids steep grades for a much longer, curving route.

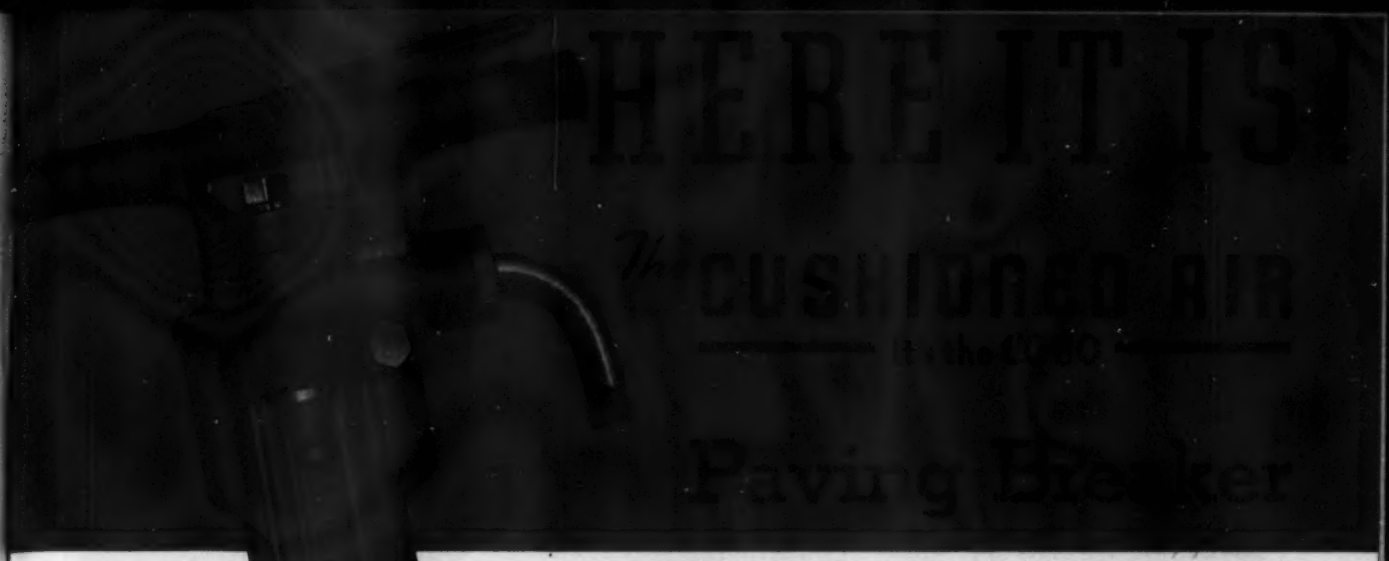
The Turnpike is to be entirely self-supporting and its original cost and maintenance will be met by toll receipts. According to Pennsylvania Turnpike officials the average toll rate for passenger cars will be $1.25 and for trucks $4 to $10 per through trip. For vehicles traveling less than the full length of the Turnpike, toll charges will vary from one cent per mile for passenger cars to four cents per mile for heavy trucks. Due to the saving of mileage compared to the two existing routes and the elimination of nearly 10,000 feet of climb it is estimated large trucks will save $27 a trip by taking the superhighway route.

Superhighway Will Revert to State

According to Turnpike authorities the $35,000,000 in Turnpike bonds will be redeemed from the RFC in 1954 at which time the superhighway will become part of the regular toll-free state highway system. It is estimated that Pennsylvania will receive millions of additional dollars in gas taxes through the increased gas sales resulting from the widespread use of the Turnpike route.

Completion of the 160-mile "all-weather" Turnpike will mark the forging of another link in a final chain of coast-to-coast superhighways that will intensify the economic and military unity of the United States.

● Roy Maxwell's Bucyrus-Erie 44-B does some heavy digging on the L. M. Hutchison contract in Huntingdon county.



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Shots from the FIRING LINE

Revised Friant Dam Bids Received

Five bids for the construction of Friant Dam, varying from a low of $8,715,358.50 to a high of $12,483,173.50, have been taken under consideration by the United States Bureau of Reclamation which announced that a contract probably will be awarded before the end of this month.

According to Walker R. Young, supervising engineer of the Central Valley Project, work can be started on the big dam on the upper San Joaquin River by early November, provided the bids are found to be regular and satisfactory to the Government.

The proposals, which had previously been returned to the bidders for labor wage changes were finally opened September 14 in Sacramento, California. Bids received were:

Griffith Co. and Bent Co., 418 South Pecan Street, Los Angeles	$ 8,715,358.50
Shasta Construction Co., San Francisco	9,105,760.00
West Coast Constructors, Inc., Los Angeles	9,197,169.50
Winston Bros. Co., The The Arundel Corp., D. W. Thurston, American Concrete & Steel Pipe Corp., and L. E. Dixon Co., Los Angeles	12,368,660.00
Friant Construction Co., San Francisco	12,483,173.50

All the proposals are to be considered before a contract is awarded. The Friant specifications provide that the successful bidder must start work within 30 days after receipt from the Bureau of Reclamation of an official notice to proceed with construction. The contractor will be allowed 1,200 calendar days, or about three years and three months, to complete the job which is located 20 miles north of Fresno and about 21 miles east of Madera, California.

The bids are for performing all work, including furnishing labor and equipment, for the construction of Friant Dam, which will be 300 feet high and 3,430 feet long. The bids do not include the furnishing of materials which are to become part of the completed structure. The Government will purchase separately through competitive bidding such items as cement, structural and reinforcing steel, pipe, metalwork, and machinery.

The Friant contract will involve the excavation of about 770,000 cubic yards of earth and rock to prepare the dam site foundation; stripping 600,000 cubic yards of overburden from a sand and gravel deposit downstream from the dam site; handling 3,222,000 tons of sand and gravel; manufacture and placement of 1,850,000 cubic yards of concrete in the dam and 57,000 cubic yards of concrete in appurtenant structures; installation of 3,300,000 pounds of reinforcement bars, about 3,800,000 pounds of gates and valves, 3,440,000 pounds of tubing and fittings, and 3,000,000 pounds of pipe, machinery and miscellaneous metalwork.

● Ruston-Bucyrus draglines do their bit for England as they excavate dirt in London's Kensington Gardens to be used in filling sandbags for protection against enemy air raids.

Queens-Midtown Tunnel Nears "Holing Through"

Commissioner William H. Friedman of the New York City Tunnel Authority has announced that the east and west headings of the $58,000,000 Queens-Midtown Tunnel are approaching each other at the rate of about ten feet a day and will be "holed through" in November. The tunnel is expected to be opened to traffic about a year after the two tubes are connected. The authority estimates that about 10,000,000 vehicles will use the tunnel during its first year of operation, with the total rising to 16,000,000 by 1952.

Contract Let on Black Canyon Wasteways

Henry L. Born of Caldwell, Idaho, is the successful bidder, at $119,842 for construction of two wasteways on the Black Canyon Canal, which will serve the Payette Division of the Boise Federal Reclamation Project, in Idaho.

The contract involves the excavation of approximately 410,000 cubic yards of material and also covers construction of miscellaneous items, including drainage inlets, lateral crossings, bridges and road crossings. The contractor is allowed 200 days in which to complete the job after notice to proceed is received.

Black Canyon Canal, with an initial capacity of 1,090 second-feet of water, heads at the Black Canyon Dam and runs west for thirty miles. It follows the southern edge of the Payette Valley, through the orchards of Emmett Slope and then along a steep hill near Plymouth, Idaho, where it crosses the Payette-Boise summit. Thence it divides into branches. The canal also includes nine tunnels, with a combined length of over two miles. Work on the canal is completed and construction of the lateral system is under way.

Shoshone Canyon Conduit Contract Awarded

Construction of controlling works and tunnels for the Shoshone Canyon conduit, Heart Mt. Division of the Shoshone project in Wyoming has been awarded in a contract recently issued by government authorities to the Utah Construction Company of Ogden, Utah, who submitted a successful bid of $217,174, which was the lowest of three proposals received and opened by the Bureau of Reclamation at its Cody, Wyoming office on July 27, 1939.

The Shoshone Canyon conduit, 12 feet in diameter and with an initial capacity of 1,200 second-feet, will head at the Shoshone Dam and will tunnel a distance of 3 miles down the south side of the canyon of the Shoshone River. This contract covers the controlling works at the head of the conduit and tunnels on a 850-foot section.

Stored water carried by this conduit will be divided by diversion works at the

● Mounted on a General Motors truck this portable Lincoln-Welder completes a field repair job. This unit, which is called the Tournacar Welder, marks the increasing trend of on-the-job repair and service operations.

outlet portal, that for the Heart Mt. Division being siphoned across the Shoshone River and that for the proposed Oregon Basin Division continuing along the south side of the river.

The Heart Mountain Canal, now nearing completion, begins at the outlet of the Shoshone Canyon conduit and extends northeast a distance of 28 miles to supply water for the irrigation of 41,000 additional acres of desert land, near the area already developed in the Shoshone project in Wyoming.

The contractor is required to complete the contract awarded within 300 days after notice has been received to proceed with the work.

Marshall Ford Dam Contract Enlarged

Secretary of the Interior Harold L. Ickes has announced the approval of a change order by which the contract held by Brown & Root, Inc., and the McKenzie Construction Company, for the building of Marshall Ford Dam was amended so as to provide for commencement of the second stage of construction of a high, flood-control dam.

The original contract, awarded December 3, 1936, called for construction of the so-called low dam at Marshall Ford, the first stage, a structure with a maximum height of 190 feet, which is now virtually completed. It was planned ultimately to enlarge the dam by widening the base and bringing the crest up to a maximum height of 270 feet above the foundation. This would provide a reservoir of a capacity of 3,120,000 acre-feet. Prior to completion of the low dam, Congress last spring appropriated $5,000,000 to continue the work, looking toward completion of the second stage without interruption.

The Bureau of Reclamation, which is in charge of the dam, after considering all elements of the problem, recommended increasing the quantities of various items of work specified in the original contract in order to have the present contractor, who has the necessary plant and equipment on the ground, bring the full base of the high dam to elevations approximately the

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● Pulling up a big one with a cable attached to its dipper tooth this Bucyrus-Erie 33-B uprooted 300 trees in five days for the Callan Construction Company, on a highway stump-clearing job for the town of Barrington, Rhode Island.

same as the crest elevations of the low dam. The principal additional work provided in the change order involves the pouring of about 325,000 cubic yards of concrete in a block 52 feet thick and 80 or more feet high along the upstream face of the low dam.

Other work involved includes installation of outlet pipes, placing of control gates, removal and reinstallation of trashrack structures, etc. The work covered by the change order is estimated to cost approximately $2,574,000.

The contractor is allowed 230 calendar days in which to complete the new work.

When this job is completed, there will still remain the work of raising the entire dam something more than 70 feet to complete the high dam.

Marshall Ford Dam is one of a series of structures comprising the Colorado River of Texas flood control and power project. Only Marshall Ford Dam, the principal flood control structure, is under the jurisdiction of the Bureau of Reclamation. The other units are under the jurisdiction of the Lower Colorado River Authority, a Texas agency.

The high dam at Marshall Ford is considered essential to adequate control of the Colorado River of Texas, a particularly dangerous stream, subject to quick floods of great heights.

New York Closes North Tube of Lincoln Tunnel

Lincoln Tunnel's North tube, partially completed but as yet unused, was sealed October 1 by the Port of New York Authority to await indications of an increase in traffic.

Completion of the tube, passing under the Hudson River to link New York and New Jersey, will not be warranted until there is a 65 per cent increase in traffic carried by the tunnel's south tube, according to announcement by Lawrence J. Keefe, secretary of the authority.

The north tube to date has cost $25,000,000 and $12,000,000 more will be necessary for remaining work, including paving, tiling, wiring and approaches. Remaining work would take a year and a half from the time the tube is reopened, it was stated. Last of the current contracts were completed by October 1. The project, now holed through and lined with concrete, was sealed with foot-square wooden beams.

Failure of New Jersey to build adequate feeder highways to the Weehawken terminal was blamed in part by the Port Authority for traffic's being less than anticipated.

The south tube, with an estimated capacity of 6,000,000 cars a year, has been accommodating only about 10,000 a day, a rate of 3,650,000 a year. Keefe estimated the tunnel will lose $750,000 this year.

Award Section of Contra Costa Canal

The Oakland firm of Heafey-Moore Company and Fredrickson & Watson Construction Company with an offer of $276,365 has been announced the low bidder for construction of an additional nine miles of the Contra Costa Canal of the Central Valley Project.

Seven bids were received by the United States Bureau of Reclamation for the work which extends from a point three miles west of Pittsburg, past Nichols, Port Chicago and Clyde to a point two miles northeast of Concord in Contra Costa County. The second low bidder was J. A. Terteling & Sons of Boise, Idaho, with an offer of $288,770.

Walker R. Young, supervising engineer of the Central Valley Project, said construction is virtually completed on the first 12 miles of the Contra Costa Canal, except for the four pumping plants which are about half completed. Construction is three-fourths completed on the section between Mile 12 and Mile 20.

The new section from Mile 20 to Mile 29 will include five siphons, four highway culverts, several bridges, and the 5,772-foot Nichols wasteway leading from the canal to Suisun Bay. In addition, the contract will cover a separate 1,000 feet of canal north of Pacheco, consisting of a long siphon under the proposed four-lane Willow Pass Industrial Highway. The canal contractor will be allowed 500 calendar days in which to complete the job.

Bartlett Dam Completed

Bartlett Dam, highest multiple arch dam in the world, is complete, according to the announcement of John C. Page, Commissioner, Bureau of Reclamation.

Located near Phoenix, Arizona, Bartlett Dam is 286½ feet high and 3 city blocks long. It took 2½ years to build and cost $5,200,000.

The dam's completion adds 65 billion gallons of water storage capacity to the total afforded the arid West by the Bureau of Reclamation's 147 other dams.

It marks another step in the Bureau's 37 years of conservation work. It insures a dependable supplemental water supply for 250,000 acres of rich, highly developed irrigated lands on the Salt River project in Arizona.

The entire cost of the dam will be returned to the Government in 40 years by the water users.

With the completion of Bartlett Dam both the Salt River and the Verde, major rivers of Central Arizona are fully harnessed for beneficial use. Damaging floods are made remote.

In addition to the construction of the Bartlett Dam, the Bureau's irrigation development and conservation program for Arizona's Salt River Valley includes the Roosevelt Dam, completed in 1911, and other works. Salt River Valley is the largest irrigated area in the State, where farming is dependent upon irrigation.

Bartlett Dam attracted world-wide attention during construction because of its height and multiple arch design. Engineers from Mexico, England, Russia, France, Australia, Iraq and China came to inspect it.

Engineers call it a multiple arch dam because of the 10 great half-cylinders or arches on the upstream face. Chosen for effectiveness and economical construction, the multiple arch design is exceedingly picturesque. It gives the

impression of a gigantic pipe organ, with mammoth cylinders all of equal length and width. Each cylinder is 48 feet wide.

The downstream face of the dam consists of 9 triangular-shaped buttresses. Both arches and buttresses slope into and brace each other. Both are built of concrete reinforced with steel and are hollow rather than solid, for maximum strength with minimum material.

At one end of the dam is a spillway for emergency overflow consisting of a concrete-lined channel 170 feet wide and 550 feet long, closed with three huge steel gates, each 50 feet high by 50 feet wide. Each gate weighs 185 tons.

The dam was completed on schedule despite tremendous difficulties, primarily because of the treachery of the Verde River, which it now harnesses. The Verde can swell from a quiet, well-behaved stream to a raging, flood-damaging torrent in a few hours.

Difficulties during construction from sudden Verde River floods arose the very first spring, in 1937. No sooner had the first concrete been placed than all work in the river bed was inundated. A heavy warm rain brought down an accumulation of snow in the mountains.

Undaunted, the workmen dug out from the first flood, only to receive another two weeks later, and then still a third only three weeks later. By this time digging out after a flood was routine work and the job was soon in shape and before long the buttresses on the left side of the dam were high enough to divert the river between them. The workmen started to remove the 80 feet of sand and gravel overlying rock foundations on the right side of the old stream bed.

But the Verde River was not so easily controlled. On July 9 another flood descended on the work and completely filled the deep excavation. After the river flow decreased, the river water was pumped out, power shovels and trucks went back to work, and the fight was on again.

During the excavation work huge cofferdams were built of the excavated material and placed on the upstream and downstream sides of the excavation in the river bed to complete a semicircle of dykes—with the partially completed buttresses on the left side of the river—to keep the river water out of the excavated area.

Work was pushed with all speed to get the concrete structure up to stream bed before another flood. First concrete in the deep section on the right side of the stream was placed in August and the last foundation in the area covered with concrete shortly before Christmas, 1937.

Completion of the dam to river bed elevation was nearly in sight and workmen were beginning to breathe with relief when suddenly a rain of cloudburst proportions swelled the Verde to a greater flood than ever before. Nearly 50,000,000 gallons of water a minute washed over and around the partly finished arches and buttresses of the dam. Equipment and materials were lost.

But within 60 days work was again in full swing, and despite more floods the dam was completed on schedule this month.

Construction of the dam required excavation of 430,000 cubic yards of earth and rock and the placement of 180,000 cubic yards of concrete. It required 1,000,000 sacks of cement, 3,500 tons of structural steel, 1,250 tons of gates and hoists and 750 tons of outlet machinery.

The three spillway gates of the dam are an engineering accomplishment in themselves. They hang from immense chains which pass over sprockets on the gate hoists to three great concrete counterweights, each weighing 185 tons to balance the weight of the gate leaf on the other end. The gate leaves consist of steel girders covered on the upstream side with steel plate half an inch thick. Individual 7½-horsepower electric motors, comparatively tiny considering the size and weight of the gates and their counterweights, operate each gate. The gates can be raised 50 feet in less than three hours. All can be raised simultaneously. Two gasoline engine-driven-generators supply power for the gate hoist motors.

Foundation grouting was an important phase of Bartlett Dam's construc-

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tion. The foundation rock of the dam was hard, fine-grained granite, like that on all major dam building jobs, but cut by many seams and cracks, each a potential path of travel for water to pass under the dam. Workmen had to drill 100 feet below foundation rock and force a mixture of cement and water under high pressure into the holes. Thus the mixture spread into and choked the seams and cracks. Bartlett Dam required nearly 7 miles of such grout hole drilling, and 28,000 cubic feet of the grout mixture.

Motor Taxes Supply 40 Per Cent of State Revenue

Approximately 40 per cent of all state revenues was derived from motor fuel taxes and registration fees in 1937, the last year for which complete data are available according to the Federation of State Tax administrators. Motor fuel taxes represented 29 per cent, and registration fees 9.5 per cent of all revenues from state taxation during the year.

Other special motor vehicle taxes which increase the motor vehicle operator's burden include operator's licenses, ton-mile taxes, special title taxes, and weight or capacity taxes. When these are added nearly half of all state tax collections is taken from the pockets of highway users.

Last Shipment of Quarry Stone at Fort Peck

The last shipment of quarry stone to be used for rip-rap was unloaded at Fort Peck Dam last August. This final shipment of quarry stone brought near a close quarry operations which have extended through three summers in which almost 486,200 solid cubic yards of stone weighing 1,181,000 tons were quarried from Snake Butte, 14 miles south of Harlem, Montana, and shipped by rail a distance of 151 miles to Fort Peck. Some stone is still being shipped from the quarry for use as rip-rap at Fresno Dam, near Havre, Montana. However, most of the machinery and equipment used in quarry operations are being prepared for shipment to Fort Peck.

The first shipment of quarry stone left Snake Butte Quarry for Fort Peck July 19, 1937. Operations carried on since that time have furnished quarry stones weighing from 1 to 20 tons, which have been placed as a protective blanket on the upstream face of the dam or stockpiled for future use. At this time, about 297,400 solid cubic yards of quarry stone, weighing almost 722,700 tons are in place on the upstream face of the dam and dike section.

Placing of quarry stone is following close behind the placing of hydraulic fill, on which good progress is being made. Dredges Jefferson and Missouri placed 895,000 cubic yards of hydraulic fill during the period August 1 to 15, inclusive. The Jefferson unit is operating with 10 pumps at various points in its pipe line, and the Missouri unit is operating with 9 pumps. Total hydraulic fill placed by the two units this year is 8,435,000 cubic yards.

Large Material Purchases, Equipment Rentals by WPA

Private industrial concerns and equipment contractors have received nearly $1,700,000,000, in orders for purchase of construction materials and equipment and rental of equipment for use on WPA projects according to an announcement by Deputy Work Projects Commissioner Howard O. Hunter.

In addition to $1,075,811,148 spent for purchase of materials, equipment and other supplies, WPA operations required the expenditure of $604,973,815 for rental of equipment from private individuals and contracting concerns during the four years ended June 30. Local governments sponsoring WPA projects provided more than two-thirds of the funds for purchases and more than three-fifths of the funds for equipment rental.

Nearly every branch of the capital goods industries was stimulated by large orders for products used in public improvements constructed by WPA workers. The largest amount was $378,000,000 for stone, glass and clay products, comprising more than one-third of the total purchases. Included in this total were approximately $100,000,000 for cement, $75,000,000 for sand and gravel, $65,000,000 for crushed stone, $50,000,000 for concrete products and $50,000,000 for brick and tile.

While local sponsors were spending $606,315,850 to the Federal Government's $469,495,298 for these purchases, the sponsors were providing $364,814,849 for equipment rentals to the Federal Government's $260,158,966.

More than half of the $605,000,000 of rental expenditures was for trucks and more than one-third was for paving, roadbuilding and other construction equipment. An additional amount was spent for the hire of teams and wagons.

A survey indicating the quantity and variety of equipment rented from private individuals and firms showed that during the two weeks ended November 19, 1938, WPA projects used more than 75,000 individual pieces of rented equipment. These included more than 55,000 trucks, more than 5,000 power shovels, graders, draglines and similar equipment for excavation and grading, and more than 5,000 cranes, mixers, rollers

● Outlined against clouds and sky, this Caterpillar tractor pulling two Athey dump wagons offered a striking picture as it worked on the excavation of the world's most modern ship model testing basin at Cabin John, Maryland.

and similar equipment for handling and placing materials. Other pieces of equipment included trucks and cars for workers' transportation and quarrying and crushing machinery.

OBITUARIES

M. L. Fykse

Mitchell L. Fykse, 54, chief engineer in charge of quarry and mining shovels for Bucyrus-Erie Company, died at his home at South Milwaukee, Wisconsin, on August 15, after an illness of about three months. Death was caused by a heart ailment.

Mr. Fykse came to this country from his native town of Hardanger, Norway, in his early youth, and in 1908 was employed in the engineering department of Bucyrus Company, for which company and its successor he worked in various capacities until the time of his death.

A prolific inventor, Mr. Fykse constantly worked on shovel improvements, and the cream of his many inventions is represented by 13 patents assigned to Bucyrus-Erie Company. Outstanding among these patents was Mr. Fykse's development of a saddle block for divided dipper handles in 1924, which at present is widely used under license by practically all shovel manufacturers.

Other important patents based on Mr. Fykse's ingenious ideas are the "steering by swinging" principle, the "Y-shaped" dipper front, and one of the three basic patents covering the distinctive type of caterpillar treads which are characteristic of all Bucyrus-Erie machines. These inventions and many others made him a widely known figure in the excavating machinery industry.

Mr. Fykse's personality was characterized by a friendly geniality and a solid sense of humor, neither of which he permitted to interfere with his own or anyone else's work.

His devotion to his job was exceeded only by his love for his family and the home he provided for them. He is survived by a wife and two children.

Funeral services were held on August 17, with the Rev. W. Roy Columbus officiating. Interment was in South Milwaukee's Congregational cemetary.

Ralph E. McLean

Ralph E. McLean, 63, widely known and well-liked figure in the stone industry, died in his home at East St. Louis, Illinois, on July 24.

Mr. McLean, who at the time of his death was President of the East St. Louis Stone Company, was the victim of a paralytic stroke. Funeral services were held in East St. Louis at the Kurrus chapel on July 25 with the Rev. L. D. Bowman officiating.

Born the fifth of seven children in the McLean family, Mr. McLean was a native of East St. Louis where he attended public schools followed by later training at the Bryant-Straton business college in St. Louis, Missouri.

From 1897 to 1900 he was commissioner and commissary clerk at the Southern Illinois penitentiary at Menard, appointed by Gov. John R. Tanner. He served one term on the board of education and also represented his precincts as a Republican committeeman.

From the Missouri Malleable Iron Company, where he obtained his first job in private industry, he went to the East St. Louis Stone Company as a clerk. He advanced to secretary and then to general manager and president.

Because of his interest in the city of East St. Louis, Mr. McLean created for the police department a pistol range on property he controlled near Falling Springs. He provided necessary equipment, furnished the labor required in constructing the range, and refused to take any compensation for his efforts.

Mr. McLean was a member of Gothic lodge, A. F. & A. M., Mississippi Valley Consistory, Ainad Shrine, Knights Templar and Modern Woodmen of America. He is survived by his widow, Mrs. Susan Crissey McLean; a son, Morris McLean; a brother, N. C. McLean; grandsons, Edwin, Milton and Donald McLean; nephews, Harold Baker, former U. S. district attorney, Malcolm and N. C. McLean, Jr.

Drilling and Fishing Tools

By

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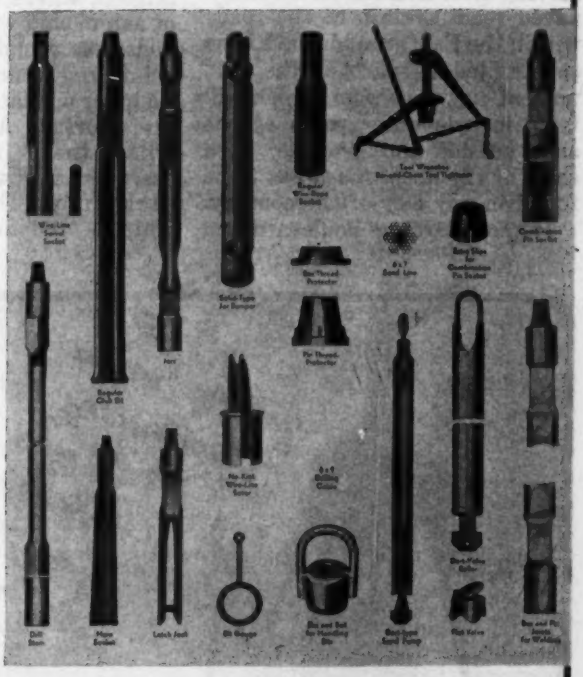

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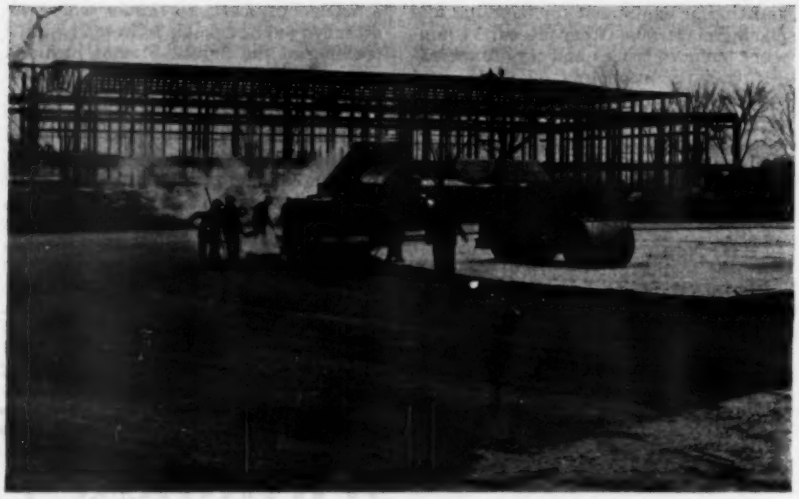
"Digging In" A World's Fair

(Continued from page 567)

preliminary traffic, which developed the weak spots and enabled engineers to make repairs before the roads were finished for Fair traffic. There is a total of one million square yards of various types of paving for the streets and roadways, and 300,000 more square yards of paving in the great parking areas.

In some instances cinders were used for a better surface. In a few places a corduroy mat foundation of heavy timbers was covered with a layer of bank gravel, this serving later as a sub-base for the paved road. Certain of the roads within the Fair grounds have been constructed as part of the permanent city park plan, which will later include other parts of the area outside the grounds, with some of the finest roadways to be found in any city of the country.

Horace Harding Boulevard and a part of the central Parkway Extension, where the greatest mass of ash mound with underlying silt beds was found, was paved with reinforced concrete and the remainder will later also be of a concrete surface. An intramural road within the Fair grounds will remain as a part of the metropolitan park project. This road during the Fair is used for intra-mural bus lines. Bituminous macadam, which is flexible, easy to repair and easily opened for service lines and for patching, was used on most of the Fair roads except those noted above. These are all main routes within the grounds.



● Rolling down bituminous material on roadway and plaza in front of one of the exhibition buildings.

Macadam Road Construction

For the bituminous macadam roads a base course of ¾ inch to 3 inch stone, rolled to a thickness of 4 inches, compacted was used. Holes were filled with screenings or sand and re-rolled. Over this was cold laid plant mixed bituminous macadam in two courses, consisting of a 2 inch binder and 1 inch wearing surface.

A similar mixture direct, or consolidated with the existing base of ash, was used for light traffic ways, with a 2½ inch binder course and a one inch top. Wood curbs were placed. These ways are mainly for pedestrian traffic. For the heavier traffic roads, concrete curbs were placed. The walks also were constructed of a bituminous mixture rolled on a base of cinders, after which five to seven pounds per square yard of limestone chips were spread and rolled in.

A stone and concrete seawall was built along the bay front and cellular sheet steel piling was driven for a total of 70 feet to form a boat basin. Estimated cost of converting the Fair site into a municipal park is $5,500,000.

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Book reviews

The Athey Truss Wheel Company, Chicago, Illinois, manufacturers of Athey Forged-Trak Dump Trailers has released literature describing and illustrating their three types of dump trailers. These trailers, capacities of which range from 10 to 18 yards, are the Bottom Dump as used on dirt excavation—the Quarry Trailer in rock—and the 2-Way has a universal application, as it will handle dirt, rock or mixed materials. Copies may be had from the manufacturer or from any "Caterpillar" distributor.

The complete line of Ingersoll-Rand rock drills and associated equipment, together with a brief and interesting history of rock drill development, are presented in a new profusely illustrated 88-page catalog just published by the manufacturer. Installation and shop views as well as tables of operating and physical characteristics for each class of machine are presented in the volume. Eight pages of engineering tables and other useful data are also included in the book. Ask for form 4301 when writing to New York or any of the branch offices.

Because the practice of hitching a blade grader behind a "Caterpillar" Motor Grader is becoming increasingly popular among contractors, municipalities and cities, the Caterpillar Tractor Company of Peoria, Illinois has put out a folder called "Doubling Up." Copies can be had upon request.

The Earth Mover and Road Builder have recently published a brochure, The ABC's of Soil Stabilization. The book contains reprints of the series of articles on the subject of soil stabilization which appeared in The Earth Mover and Road Builder from June 1938 to January 1939. The material presented is a non-technical discussion of the theory and principles of soil consolidation. Books are available at 25c each.

The Harnischfeger Corporation announces the completion of Bulletin W-26, "The 200-Ampere Multi-Arc Welding Service," a new bulletin which completely describes the design of the new welder recently introduced by P&H. Bulletin W-26 is complete with big illustrations and cut-away views. Copies of this bulletin may be obtained by writing the Harnischfeger Corporation, 4400 West National Avenue, Milwaukee, Wisconsin.

Allis-Chalmers announces the release of a new 24 page catalog describing the Model "S" tractor—a tractor designed expressly to take advantage of the extra power in the high octane (67-72) gasolines now available. You can obtain a copy of this descriptive catalog by writing to the company.

A quick review of the various jobs Diesel track-type tractors have to do, from the roughing out to the finishing of a project, is contained in a new booklet, just issued by Caterpillar Tractor Company. Titled "From Start to Finish," the book contains 24 pages of illustrations, captions, and brief discussion. Copies of the booklet are available from Caterpillar Tractor Company, Peoria, Illinois. Form 5402 should be specified.

"Handbook of Hydraulics" by Horace W. King has been announced by McGraw-Hill Book Company of New York. Basic formulas and tables in hydraulic engineering and methods of applying them in the solution of practical problems are presented in this revised, enlarged third edition. A copy of this 617 page, pocket-size book can be had from the publishers for $4.00.

Two new pictorial folders filled with job pictures and engineering data showing methods of increasing scraper and tractor efficiency are now available through R. G. LeTourneau, Inc., manufacturers of construction equipment. A rooter folder and a tractor crane folder explain how equipment can multiply its usefulness with the help of these units. Copies of the folders may be secured by writing to R. G. LeTourneau, Inc., of Peoria, Illinois, or Stockton, California.

A new bulletin has just been issued by Sullivan Machinery Company on their Portable Shaft, Slope and Supply Hoists. The bulletin also includes illustrations and data on two gasoline driven, quality built hoists for prospecting work. Ask for Bulletin 76-C from Sullivan Machinery Company, Woodland Avenue, Michigan City, Indiana.

"Keep Fit and Like It," by Dudley B. Reed, M. D., has recently been announced by Whittlesey House. Dr. Reed, as Director of the University Health Service at the University of Chicago has handled many people who claim they are too busy, too tired, or too lazy to exercise, approaches the topic from two angles: (1) he explains briefly the physical and nervous make-up of the human body and its need for exercise; and (2) he shows how exercise can be fun rather than the grudging chore so many make of it. With an eye to the fact that different people need different sorts of exercise, the author tells "when" and "how much" and evaluates every form of exercise from swimming to tennis, and from volley ball to golf. Copies sell for $2.50 and can be had from the McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, New York.

American Optical Company, Southbridge, Massachusetts, announces its new industrial safety equipment catalog is now available and will be mailed on request without obligation. The catalog describes in detail the concern's complete line of eye, head, and lung protective equipment, and also its new line of safety clothing.

Trade notes

Chain Belt Company of Milwaukee, one of the leading manufacturers of sprocket chain, conveyors and construction machinery, has acquired the business and all of the net assets of the Baldwin-Duckworth Chain Corporation of Springfield, Massachusetts. The plan of acquisition, which is in effect a merger of two well-known and long established companies, provides for the issuance to Baldwin-Duckworth stockholders of 139,537.5 shares of the no par common stock of Chain Belt Company.

Blaw-Knox Company announced the appointment of Lawrence E. Joseph as executive officer in charge of its Blaw-Knox Division. Mr. Joseph succeeds R. F. McCloskey, Sr., a company vice president, who was placed in charge of the development of new products for the entire corporation.

The road machinery division of Gar Wood Industries, Inc. has announced the appointment of Duke Kerrick as field representative. Mr. Kerrick was formerly connected with the Continental Roll and Steel Foundry Company of East Chicago, Indiana. The Continental tractor equipment division was recently acquired by Gar Wood Industries, Inc.

The expanding business of D. W. Haering & Company, nationally known water consultants in Chicago, Illinois, has necessitated removal of the company offices to their plant at 2308 S. Winchester Avenue, in Chicago. The company laboratory will be retained at 3408 West Monroe Street where the previous office quarters are being altered to provide new and larger library facilities for the research staff.

H. V. Huleguard has been appointed General Manager of The Whitcomb Locomotive Company, Rochelle, Illinois, subsidiary of The Baldwin Locomotive Works, Philadelphia. For several years Whitcomb sales and engineering activities have been concentrated at Philadelphia. Effective September 1, these departments will be transferred to Rochelle.

The Frank G. Hough Company, manufacturers of hydraulic loaders and other tractor front-end equipment have centered their activities at their new plant located at Libertyville, Illinois, a suburb of Chicago. Executive offices and the engineering, purchasing and sales departments will be located at the new plant. Manufacturing will continue at Plant No. 2 at New Holstein, Wisconsin, which will concentrate on standard models of Hough Equipment.

Under the direction of E. N. Robinson, field representative for the Stewart-Warner accessory division, first

showings of the recently completed Stewart-Warner Motor Mile Recording Tachometer slide film, "The Invisible Mile," will be made during September at a series of jobber and fleet owner meetings. As the title suggests, the theme of the film is the invisible and unmeasured miles accumulated by truck motor revolutions, as contrasted to road miles indicated on the speedometer.

In addition to demonstrating the uses of the Stewart-Warner Motor Mile Tachometer as the basis for fleet costs records, "The Invisible Mile" illustrates such pertinent trucking factors as safety; reduction of fuel, oil, and maintenance costs; actual case histories of fleet owners who are using the tachometer, etc. Created primarily for demonstration before Stewart-Warner distributors and dealers, "The Invisible Mile" has been so filmed as to make it of educational value to fleet owners who wish to show it to their staff of drivers. Interested persons should write to the Stewart-Warner Corporation.

In the September 9th issue of the Saturday Evening Post, The Timken Roller Bearing Company inaugurates "Miles of Smiles" as their new advertising theme. The basic idea which underlay this new Timken campaign was the selection of an advertising appeal that would apply to the bearing market in the Railway field, and at the same time be applicable also to those diversified fields in which Timken operates, such as the motor car, oil well, road building and machine tool.

FOR SALE

RATES: 60c per line—minimum charge $2.40. Repeat insertions with no change in copy—three insertions for the price of two. ¶ Display advertising in this section at published display advertising rates. ¶ Estimate 41 characters per line, counting all spaces and punctuation as one character each. Allow ten characters for box number for blind advertisements. If address given, counts same as advertising copy. ¶ Rates are net (no commission, no discount) and payable in advance of publication. Send your remittance with insertion order and copy. ¶ Closing date—15th of preceding month. Example—January issue closes December 15.

Address all box numbers c/o EXCAVATING ENGINEER . . . . . at South Milwaukee, Wisconsin

SMALL SHOVELS, CRANES AND DRAGLINES
Up to 2 Cubic Yards

BUCYRUS-ERIE GA-2 GAS-AIR HIGH LIFT SHOVEL. Good operating condition. Located Eastern Pennsylvania. Box 2289

BUCYRUS-ERIE Type B High Lift ¾-yard steam shovel. Operating condition. Located vicinity Boston. Box 2401

BUCYRUS-ERIE Type B ¾-yard steam shovel. Operating condition. Located Eastern Pennsylvania. Box 2404

P&H MODEL 400 GASOLINE SHOVEL. Waukesha engine rebuilt late 1938. Machine generally good condition. Located Arkansas. Box 2285

BAY CITY GAS TRACTOR TYPE SHOVEL AND DRAGLINE—¾-swing. Fair condition. Located Pittsburgh. Box 2286

LINK-BELT MODEL K-40. 1¼-yard gasoline shovel. Speedomatic control. Kohler light plant. Generally good condition. Located Boston. Box 2295

LORAIN 75-D gasoline combination 1¼-yard shovel and 70' boom dragline. Waukesha engine. Caterpillar extension included. Kohler light plant. Operating condition. Located Boston. Box 2391

LORAIN-40 Gas Shovel. Electric starter. Waukesha engine. Located North Carolina. Box 2267

BUCYRUS-ERIE 43-B Gas shovel. 23' boom, 17' dipper handle, 1½-yd. dipper. Chain crowd. Electric starter. Wisconsin 6-cylinder 6"x7" Model E engine. Extensively repaired. Excellent shape. Located vicinity Boston. Box 2257

MEAD-MORRISON gas ⅝ yd. shovel. Buda 4 cylinder model YTU engine. Operating condition. Located central Wisconsin. Box 2303

BUCYRUS-ERIE B-2 1 yd. steam shovel. Operating condition. Located vicinity Detroit. Box 2308

NORTHWEST MODEL 105 gasoline 45' boom crane. Twin City 6¼"x8" 4 cylinder engine. Very good condition. Located vicinity Duluth. Box 2298

BUCYRUS-ERIE 32-B gasoline shovel. 21'6" boom—16' dipper handle—⅞ yd. dipper. Chain Crowd. 40' boom clamshell equipment. Wisconsin D-3 6 cylinder 5"x6" engine. Electric starter. Extensively repaired. Excellent condition. Located Eastern Pennsylvania. Box 2307

BUCYRUS-ERIE 41-B — 1¼-YARD STEAM SHOVEL. Located near Boston. Electric light plant. Very good price. Box 2389

BUCYRUS-ERIE GA-3 Gas-Air high lift shovel. 24' boom, 18'4" dipper handle. 1¼ yd. dipper. Waukesha 6¼"x8" 4 cylinder engine. Electric starter. Quantity spare parts included. Excellent condition. Located Eastern Pennsylvania. Box 2313

KOEHRING MODEL 301. Combination shovel, and crane. Crane boom 40'. Shovel equipment ¾-yd. capacity. Engine Wisconsin Model R.B. Rebuilt A-1 condition. Located Kentucky. Box 2403

LINK-BELT MODEL K-2. 50' boom gasoline crane. Waukesha engine. Located Boston. Box 2294

LINK-BELT MODEL K-38. Combination 1 yard shovel and 50' boom gasoline crane. Waukesha engine. Located Boston. Box 2392

MARION MODEL 381 2 yd. shovel powered by Hesselman engine. Good operating condition. Located near Pittsburgh, Pa. Box 2304

P&H MODEL 400—Combination ⅝-yd. gasoline shovel and crane. Crane boom 35' plus 10' extension. Waukesha 4-cylinder 5"x6¼" engine. Located vicinity Boston. Box 2334

BUCYRUS-ERIE 50-B. 2-yd. steam shovel. Good operating condition. Located Central New York State. Box 2383

BUCYRUS-ERIE D-2 — DIESEL DRAGLINE. Atlas engine. Located Texas. 40' Boom, 1¼ yd. Page Bucket. Field reconditioned. Excellent mechanical and operating condition. Box 2328

KOEHRING MODEL 501 gasoline 1¼ yd. shovel. Wisconsin 6 cylinder 6"x7" engine. Electric starter. Extensively repaired. Good operating condition. Located Texas. Box 2302

LORAIN UNIVERSAL MODEL 35—Dragline—28' boom. Waukesha 4½"x6" engine. Recently overhauled. Fine condition. Located California. Box 2290

BUCYRUS-ERIE 37-B Diesel dragline. New D-13,000 Caterpillar Diesel engine. Balance machine reconditioned. First class operating condition. New shovel equipment available at reduced price. Located Milwaukee. Box 2288

BUCYRUS-ERIE 19-B ⅝-yd. gas shovel. Good operating condition. Located Western Pennsylvania. Box 2399

BUCYRUS-ERIE 19-B gas, 35' boom dragline and ¾-yd. AU drag bucket. Operating condition. Located Western Missouri. Box 2396

KOEHRING MODEL 1-A. Combination 40' boom crane and dragline. Gasoline. Wisconsin engine. Operating condition. Located near St. Louis. Box 2402

BUCYRUS-ERIE 55-B Diesel—80' boom dragline. Atlas 6 cylinder 8½x9½" engine. Good operating condition. Located Eastern Pennsylvania. Box 2342

NORTHWEST No. 8 dragline, 50' boom. Twin City oil engine. Raised portable gantry. Revolving type fairlead. 1500 watt Model E Kohler light plant. Fully enclosed house. Late model. Excellent condition. Located Pacific coast. Box 2344

NORTHWEST MODEL 105 GAS—40' boom dragline and clamshell, including Page "C" drag bucket. Climax engine. Reasonably good operating condition. Located Atlanta, Ga. Box 2345

BUCYRUS-ERIE — GA-2 — GAS-AIR 45' Boom Clamshell Machine. Good Operating Condition. Located St. Paul, Minn. Box 2346

BUCYRUS-ERIE — 52-B — DIESEL 2¼ yard Shovel and Dragline. Atlas engine. Good condition. Price recently reduced. Located Eastern Pennsylvania. Box 2347

TWO—BUCYRUS-ERIE—GA-3. GAS-AIR 1¼-yard shovels. Wisconsin D-2—6 cyl. 5¼"x6½" engines. Good condition. St. Paul, Minnesota. Box 2350

MARION MODEL 7, 1-yard steam shovel. Has not operated in the past five years. New flues recently installed in boiler. Located Buffalo, New York. Box 2354

BUCYRUS-ERIE—21-B STEAM SHOVEL. 22' boom, 15' dipper handle, 1-yard dipper. Now operating, can be demonstrated. Located Alabama. Box 2352

LINK-BELT, MODEL K-2. Gas crane. 50' boom. Also 2 extra 20' inserts to make 90'. Weight 67,000 lbs. Located St. Paul, Minn. Box 2356

BUCYRUS-ERIE. GA-2, Gas-Air. 1¼-yard shovel. Electric starter. Waukesha W.L. 4-cylinder 6¼"x8" engine. Single shaft cat. Extensively repaired recently. Located Texas. Box 2357

BUCYRUS-ERIE GA-3 Gas-Air 1¼-yd. shovel. Waukesha 4-cylinder 6¼"x8" engine. Good operating condition. Now operating Arizona. Box 2359

BUCYRUS-ERIE GA-3 Gas-Air 1¼ yard shovel. Single shaft cat. Electric starter. Waukesha 4-cylinder 6¼"x8" engine. First class condition. Located near St. Louis. Box 2363

BUCYRUS-ERIE 10-B Gasoline dragline. 28' boom. ⅜-yd. AU drag bucket. Now operating Missouri. Reasonably priced. Box 2397

BUCYRUS-ERIE 10-B Gasoline dragline. ⅜-yd. AU drag bucket. Hercules gasoline engine. Can be put right to work. Located western Missouri. Box 2398

BUCYRUS-ERIE 1035 Gasoline 40' boom dragline and clamshell, including 1-yd. dragline and clamshell buckets. 26" cat. treads. Waukesha engine. In first class working condition. Motor, Caterpillar mounting and all working parts recently checked. Located Nebraska. Box 2364

AUSTIN MODEL "MA"—Gasoline Dragline—37' Boom—¾ yd. Page "M" drag bucket. Good operating condition. Located western Nebraska. Box 2345

BUCYRUS-ERIE 22-B—1¼-yard gas shovel — chain crowd. One year old. Worked less than half the time since sold new. Located Northern Minnesota. Box 2367

BUCYRUS-ERIE 16-B Gas Shovel, Dragline and Clamshell. ⅝-yd. Shovel dipper. 35' Clamshell—Dragline boom. Winch head. Electric starter. Waukesha 6-cylinder 4"x4¾" engine. Very good condition. Located North Carolina. Box 2370

LINK-BELT K-44 Dragline. 44' Boom plus 8' Extension—52'. 1½-yd. Omaha bucket. Waukesha 4-cylinder 6¾"x8" engine. Located Northwestern Missouri. Box 2371

UNIVERSAL ½-yd. Shovel and 35' Boom Dragline. Waukesha Engine. Distributor frame for mounting on truck but not including truck. Thew caterpillar mounting available. Working condition. Located Illinois. Box 2373

5—MARION MODEL 37, 1¾-yard steam shovels, steel cab. Good working condition. Located Minnesota. Box 2362

P&H MODEL 150 ½-yard gas shovel. Late model. Excellent condition. Located near Boston. Box 2378

P&H MODEL 150 ½-yard gas shovel. Operating condition. Located western Pennsylvania. Box 2400

MEAD-MORRISON ½-yd. gas shovel. Buda engine. Has had good care and is of good appearance. Reasonably priced. Located Southern Wisconsin. Box 2395

NORTHWEST Model 105 Gas 1 yd. shovel and 85' boom dragline. Reported very good condition and ready to go to work. Located Southern Michigan. Box 2379

SPEEDER ½ yd. Gas shovel and 35' boom dragline. Good condition. Ready to go to work. Located Southern Michigan. Box 2380

BUCYRUS-ERIE 24-B Diesel 1¼ yd. shovel and 45' boom dragline including 1¼ yd. AX drag bucket. Also Kohler light plant. 30" treads. Caterpillar D-11,000 engine. Excellent condition. Located Kansas. Box 2383

P&H MODEL 700-B. 1½-yd. Gasoline shovel. Waukesha engine. Good condition. Located Connecticut. Box 2385

P&H MODEL 800. Diesel 2½-yd. shovel and 80' boom dragline. 2½-yd. Page RC drag bucket. 6-cylinder Atlas 9"x10½" engine. Completely overhauled recently. Ready for a season of hard work. Now working. Can be inspected. Located Eastern Pennsylvania. Box 2386

OSGOOD—INVADER—Gas Shovel. 15' boom. 11'6" dipper handle, ½-yd. Esco dipper. Chain crowd. Buda 6-cylinder engine. Moved only 8,000 yds. of dirt to date. Ready for a season of hard work. A-1 shape. Located California. Box 2388

FOR SALE: Brownhoist gasoline crane and clamshell, 30' boom, ½-yd. bucket. Waukesha engine. Good working condition. Elmhurst Lumber & Coal Co., Elmhurst, Ill.

FOR SALE

1-yd. Northwest shovel—clamshell—dragline—hoe
½-yd. Bucyrus-Erie shovel—drag—clamshell
1-yd. P&H shovel—dragline—clamshell
1¼-yd. P&H dragline—clamshell
EDW. M. ROCHO, Contractor, Freeport, Ill.

LARGE SHOVELS, CRANES AND DRAGLINES
2 Cubic Yards and Over

MARION — MODEL 70-E — 3½ yard Electric Shovel. Railway truck mounted. Power Equipment, 3 Phase, 60 cycle, 2300 volt. Good condition. Located Ohio. Box 2349

BUCYRUS-MONIGHAN 4-W Diesel Dragline. 110' Boom. 4½-yd. Bucket. Reported good working condition. Some extra parts included. Located Georgia. Box 2372

3-W MONIGHAN — Late type walker, knocked down ready to ship; no power or bucket, some parts needed. As/is F.O.B. Los Angeles yard, $5,000. 2-W Monighan, good condition; no power or bucket. Price as/is F.O.B. Denver, Colorado, $4 000. Full descriptions either machine on request. BRODERICK & GORDON, 3901 Medford St., Los Angeles, Calif.

BUCYRUS-ERIE 50-B Diesel Dragline Kohler Light Plant. Worked less than half the time since sold new. Good condition. Located Illinois. Box 2358

P&H MODEL 900, 3½ yard Diesel Shovel, 33-foot boom, 200 h.p. Fairbanks-Morse engine. Mounted on caterpillars. Box 2361

BUCYRUS-MONIGHAN Model 3½-T—70' boom dragline. 2½-yard dragbucket. Fairbanks Morse Diesel engine. Located Nort Dakota. Box 2366

MARION—MODEL 350—8 yard Electric Shovel. Power equipment, 3 Phase, 60 cycle, 2300 volt—Ward-Leonard Control. Mounted on railway trucks. Good condition. Located Minnesota. Box 2348

BUCYRUS-ERIE 100-B Ward-Leonard—3 phase 60 cycle—2300 volt 3 yd. shovel. Good working condition. Located Iowa. Box 2384

BUCYRUS-ERIE 100-B Ward-Leonard Electric 3 phase 60 cycle—2300 volt shovel equipped with 3½ yd. dipper. Good operating condition. Located Eastern Pennsylvania. Box 2381

ANY FAIR OFFER ACCEPTED

BUCYRUS-ERIE—Class 24 steam dragline. 100 foot boom, 5 cubic yard bucket. Skid and roller mounted. Rebuilt 1927 at a cost of $15,000. New locomotive boiler installed 1928. Will accept any fair offer. Located near Fort Worth, Texas. Box 2390

MISCELLANEOUS EQUIPMENT

SHOVEL EQUIPMENT—For Bucyrus-Erie 52-B Diesel. Handled only about 4,000 yards material. Equipment located Alabama. Box 2351

KOEHRING DRAG SHOVEL equipment for Model 301 machine. Used very little. Low price. Located Eastern New York State. Box 2353

If You Do Not Find What You Want Listed—Write Us
EXCAVATING engineer
South Milwaukee, Wis.

SURPLUS MINE EQUIPMENT
BARGAIN PRICES

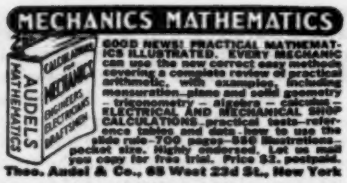
Write for prices of this equipment. Save money. Located in Minnesota.

1—Boiler, locomotive type, 150 H.P.
1—Motor, 135 H.P. squirrel cage, 1150 r.p.m., 220 v., 3 ph., 60 cy., A. C.; compensator.
3—Rotary converters, 300 Kw., HCC-6-300-1200, Forms P, D, & V, 6 and 3 phase.
1—Switchgear for 3-phase rotary converter, complete, semi-automatic.
3—Transformers, 300 Kw., 66,000 V. Primary, reconnected for 22,000 V. Primary.
1—Ainley placer gold machine, complete. 4-bowl with feed hopper for dragline operation. 40-50 tons per hour.
30—Hoists, single and double drum.
1—Bucket loader.
8—Pumps, steam (1 gas engine driven) from 49 to 3700 g.p.m.
1—Tractor, Twin City No. 12-20.
1—Water softener, 5 ft., complete.
Box 2360

AMSCO—2½-Yard Manganese Steel, heavy-duty, rock type dragline bucket, including all necessary chains and 11 teeth. Located Minnesota. Box 2368

QUARRY SHOVEL — MOTOR-GENERATOR SET — 4 YARD

ONE GENERAL ELECTRIC MOTOR-GENERATOR SET consisting of 250 HP synchronous motor 2300/4000 Volts, Hoist generator 125 KW, Swing generator 40 KW, Crowd generator 39 KW, and one Exciter motor-generator set driven by 15 HP Induction motor and one Stationary panel for starting synchronous motor. All in good operating condition, ready for immediate service. Located Minnesota. Box 2374



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Theo. Audel & Co., 65 West 23d St., New York

USED CONTRACTORS EQUIPMENT

1—Model 100 Lincoln Revolver with 100' boom and 12' Gantry.
2—275 Koehring Mixers with Electric motors.
1—200-ton Blaw-Knox Bin with weighing batchers, cement scale and push button control.
1—Robinson Pneumatic cement unloader with silo.
1—20-ton Whitcomb Gasoline Dinkey, overhauled.
4—18-ton Steam Dinkeys, overhauled.
12—30-yd. Western Lift Door Air Dump cars.
4—30-yd. Koppel Drop Door Air Dump cars.
26—16-yd. K. & J. Lift Door Air Dump cars.
6—20-yd. K. & J. Lift Door Air Dump cars.
5—2-cu. yd. Blaw-Knox Roller gate Concrete Buckets.
7—70-ton 20x36 Baldwin Switchers.
3—Jordan spreaders excellent condition.
Located Mississippi valley. Box 2355

AUSTIN MODEL 42-15 DITCHER. Twin City Gas Engine. 4-Cylinder 7¼"x9". Will cut 22" minimum to 42" maximum width to approximately 20' depth. Has seen comparatively little service and few repairs needed. Completely overhauled before last job. Will demonstrate on notice. Located North Carolina. Box 2369

LOCOMOTIVE CRANE—O&S 30-ton, steam—8 wheels standard gauge—MCB truck. 75' boom. Located central Illinois. Box 2305

DRAG SHOVEL EQUIPMENT—For Bucyrus-Erie 1020 shovel. Located Rhode Island. Box 2332

ADAMS Model 48—22' endless belt elevating grader. First class condition. Located West Virginia. Box 2341

FOR SALE: 1 Allis-Chalmers 5" Newhouse crusher; One 40' conveyor with steel frame and 24" belt; one steel hopper, 4-yd.; two dragline buckets; one rotary pump.
O. P. BOYSEN, Cochrane, Wis.

REASONABLY PRICED: 1—28-S, 1-cu. yd. Ransome concrete mixer on skids, with batch hopper and 25 h.p. gas engine, built 1930. 1—21-S, 1-cu. yd. Koehring concrete mixer on skids, 5x4 gas engine, built 1928. 1—No. 2 Kadclone dust control unit complete, will handle two 2½" Jackhammers, new 1927. All in first-class condition, located at Collins Landing, New York.
P. O. Box 150, Mount Kisco, N. Y.

TRACKSON—CRAWLER WHEELS—Type 4C-W—15 ton. Only used for demonstration. Condition just like new. Attractive price. Located Milwaukee. Box 2387

1	6½-yd. Shovel, Bucyrus 220-B Electric
15	20-yd. Air Dump Cars, Magor, S.G.
4	20-yd. Air Dump Cars, Koppel, S.G.
36	5-ton Hand Dump Cars, Western, 36" ga.
1	1000 G.P.M. pump, 300' head, 100 H.P., 3/60/2200
1	700 G.P.M. pump, 200' head, 50 H.P., 3/60/2200
1	Mine Hoist with 200 H.P., 3/60/440 motor
1	Mine Hoist, steam or electric, 100 H.P., 3/60/2200
1	Compressor 750 C. F. M., I-R Imperial 10. Steam
12	Hoist motors, new, 50 H.P. and 25 H.P., 3/60/440
1	300 KVA Fairbanks-Morse Diesel engine generator, 3/60/480
1	170 KVA Fairbanks-Morse Diesel engine generator, 3/60/460
2	862 H.P. New Casey Hedges Longitudinal Tube boilers, never used.

Rails, Relaying, all sections; Cars, Hopper, Ore, Gondola, Tank, Flat, etc. Locomotives, all capacities and types.
Send for complete machinery bulletin!
IRON & STEEL PRODUCTS, INC.
13484 So. Brainard Ave. Chicago, Ill.

EXCAVATING Bargain Counter

EVERY item on this page is priced for QUICK SALE. The equipment offered includes SURPLUS STOCK, REBUILT (carrying new equipment guarantee), and USED. Write or wire EXCAVATING ENGINEER, mentioning reference number. SAVE by filling your requirements from the BARGAIN COUNTER.

BOOMS

16'6" Chain Crowd Boom, 16-B	JA-38
18'6" Chain Crowd Boom, 21-B	JA-49
20'0" Chain Crowd Boom—48-B type for 34-B	JA-51
20'6" Shovel Boom—Steam H.L., 20-B New	JA-4
20'6" Chain Crowd Boom. 1030, New	JA-24
21'0" Steam Boom, 42-B	JA-54
21'6" Chain Crowd Boom, 37-B. New	JA-26
21'9" Steam Shovel H.L., 31-B	JA-5
23'6" Rope Crowd Boom, 37-B. New	JA-28
*24'0" Rope Crowd Shovel Boom, 43-B. New	JA-9
24'0" Erie type drag shovel boom, D-2	JA-52
26'0" Boom, Less shipper shaft brackets, 42-B	JA-53
26'0" Shovel Boom—High Lift, D-2	JA-13
26'0" High Lift Shovel Boom, 30-B. New	JA-36
*27'0" Rope Crowd Shovel Boom, 43-B. New	JA-16
28'0" Boom, 70-T, 70-C	JA-40
30'0" Steam Shovel Boom—H.L., 50-B	JA-18
31'0" Boom, 52-B	JA-41
35'6" Boom, H.L., 50-B. New	JA-43
150'0" Boom, Class 230	JA-44

DIPPER HANDLES

28'0" 30-B Dipper handle	H-28
46'0" 200-B Dipper handle	H-29

Asterisk (*) denotes more than one such item available.

DIPPERS

SMALL MACHINES

*½ cu. yd. 17-B Dippers	D-90
⅝ Yd. Plate front, 20-B Dipper. New	D-12
⅝ Yd. Plate front, 14-B Dipper. New	D-13
⅞ cu. yd. 32-B Dipper	D-72
⅞ cu. yd. 21-B Dipper	D-88
1 Yd. Plate front, 20-B Dipper. New	D-42
*1¼ Ins. tooth, 42-B, 41-B, E-2 Dippers. New	D-44
1¼ Yd. Dipper. New. 30-B, 42-B, 41-B, E-2	D-84
*1½ Yd. 34-B Dippers	D-74
1½ yd. Ins. tooth Dippers, 42-B, 43-B. New	D-85
2 cu. yd. 50-B Dipper. Used	D-69

LARGE MACHINES

2 yd. Vanderhoef, 75-B. New	D-79
*2¼ yd. Vanderhoef, 75-B. New	D-78
*2¼ yd. Vanderhoef Rock Dipper, 50-B, 52-B. New	D-75
2½ yd. Special Shallow Dipper, 50-B, 52-B, 55-B. New	D-89
2½ yd. 55-B Dipper. New	D-91
3½ yd. Coal Dipper, 75-B. New	D-81
6 yd. Two part teeth, 200-B, 320-B, 225-B. New	D-11
8 yd. Two part teeth, 320-B Dipper. Used	D-6

Asterisk (*) denotes more than one such item available.

BUCKETS

DRAGLINE

1½ yd. Beco "AX," 3,200 lbs. Rebuilt	DB-37
1¾ yd. Beco "U," 3,250 lbs. New	DB-35
6 yd. Monighan "W," 12,500 lbs. New	DB-17
7 yd. Monighan "W," 13,700 lbs. New	DB-18
5 yd. Monighan, heavy duty, 10,000 lbs. Used	DB-16

CLAMSHELL

2 yd. PF Williams clamshell bucket without teeth and counterweight	CSB-1
*¾-yd. Haiss Hi-Power clamshell buckets with teeth	CSB-2

DIPPER TRIPS

31-B steam dipper trip. New	DT-2
*42-B and E-2 dipper trips	DT-3
D-2 Erie type dragshovel dipper trip	DT-4

BOILERS

44"x17', 75 h.p. locomotive, 125 lb. working pressure A.S.M.E. std. Will fit 68-C	B-13
36"x82½" vertical boiler for type A Bucyrus-Erie machine	B-14

Asterisk (*) denotes more than one such item available.

POSITIONS WANTED

Positions wanted advertisements will be run under this heading for 5 cents per word, minimum charge $1.00. Advertisements for help wanted free of charge.

Address all box numbers c/o EXCAVATING ENGINEER . . . . . at South Milwaukee, Wisconsin

EXPERIENCED OPERATOR

Operator with 17 years' experience running shovels, draglines, clamshells, cranes and pull shovels—gasoline, Diesel, electric and gas-air models. Experience covers mine stripping, dam work, road construction, tunneling and pipe-line work. Has worked as maintenance man over six machines. Prefers work on any type of large machine, any make or power. Will go anywhere; age 38; married. Can do own repair work and furnish best of references. Box 9136

CONSTRUCTION ACCOUNTANT

Iowa Commerce Graduate would like contacts for a position in the accounting field with large construction or equipment concern. Possesses a knowledge of construction activities. References. Box 9137

DRILL OPERATOR

Position wanted as blast hole drill, pneumatic drill or compressor operator. Prefers to work on Bucyrus-Armstrong rig. Willing to go anywhere in U. S. or districts in Canada or Mexico suitable to bring family. Ex-service man, now working temporarily. Located State of Washington. Box 9138

EXPERIENCED OPERATOR

20 years' experience in construction work operating Bucyrus, Marion and Osgood standard and revolving steam shovels; P&H and Koehring gas shovels. Also 6 years as foreman on road, quarry, stripping and portable crushing plants. Do all repairing; electric and acetylene welding. Age 43, married. Now located in Middle West. Box 9134.

DRILL OPERATOR

8 years' experience on Bucyrus-Armstrong drills in quarry and open pit coal mines. Operates gas-Diesel or electric, 7-9 inch holes. Can operate 27-T, 29-T or 42-T blast hole drills. Can do own repair work; single, will go anywhere in U. S., Canada or Alaska. References. Box 9140

CONSTRUCTION MAN

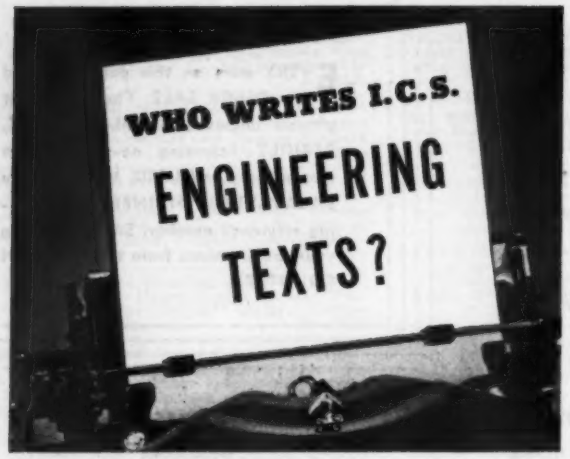
Construction man: Railroad, open pit mining, highway and well drilling. Compressor and drill operator. Can do own repair work. Is Seaman, would work on dredge. Single, 24 years of age, would like to work in South America. References. Box 9141

ALL-AROUND SHOVEL MAN

All-around experience of 28 years on shovels, cranes, draglines and pull shovels. Can overhaul any make of machine—has own set of tools. Has been foreman over 5 shovels for eight years. Work covers almost all types of jobs throughout U. S. Best references. Box 9142

HELP WANTED

Equipment Salesman—Southern Indiana Territory. Must be familiar with and able to SELL dirt-moving, rock drilling, paving and construction equipment in general. Prefer man having 5 years minimum experience machinery sales. Send full particulars, age, experience, qualifications, photograph. Replies held in strictest confidence. Box 9139



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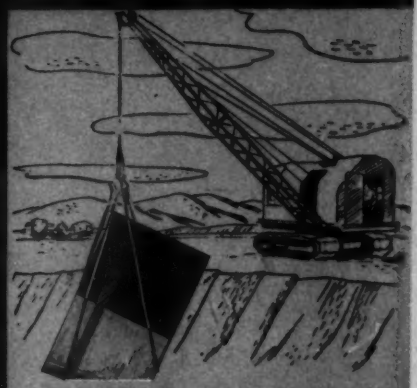

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